American Aviation

SERVING THE INDUSTRY SINCE 1937

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★

New supersonic engine designs revealed .. 15

★

Congress may probe AMC 'irregularities' . 17

★

$50 million spent on flight simulators ... 19

★

Air bases: $1 billion suppliers' market .. 22

★

Trend to one-time use of spark plugs 34

★

...vy ... stall warning device ... 24

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(...page 20)

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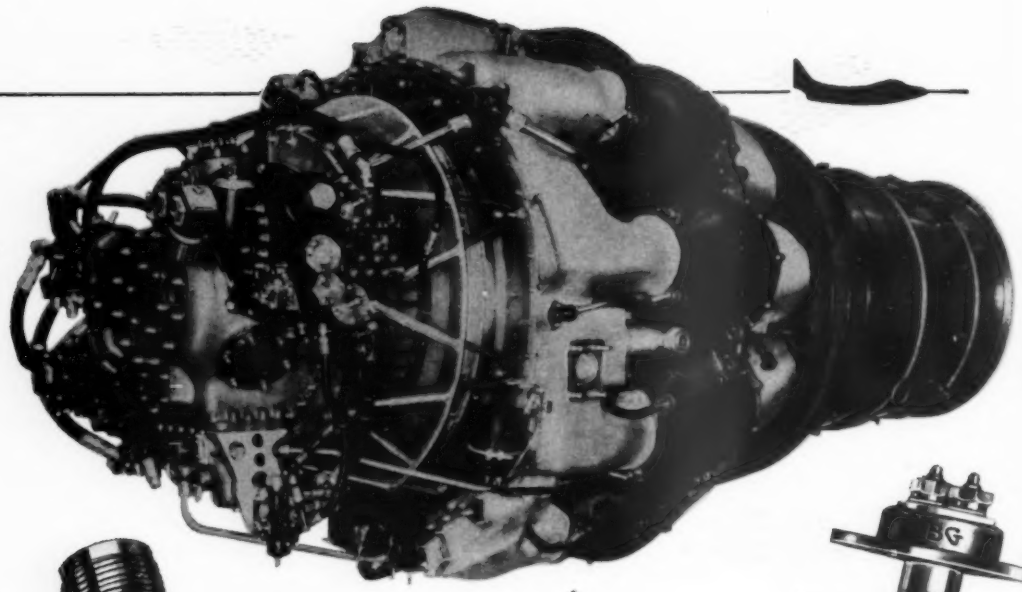

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American Aviation NEWSLETTER

Volume 15 Number 22 October 29, 1951

There won't be any cut in materials for transport planes and personal aircraft in the first quarter of 1952, despite the fact that NPA Aircraft Divisions CMP allocation was cut. Reason is that in making the allocation, Defense Production Administration specifically earmarked necessary materials for civil production.

Thus, the reduction will be in military plane parts on Aircraft Division's list and even this cut won't be as great as had been expected. The division has secured an additional 1,500,000 lbs. of aluminum from elsewhere in NPA—enough to fill about 70% of screened military requirements. Without this aluminum, only about 32% of authorized military parts could have been produced.

•

Shortage of aircraft forgings is the latest development hampering plane production. Both the military and the industry have been aware of the problem for many months but little has been done so far.

Aircraft Industries Association is now conducting a survey to determine how much extra forging capacity is needed and where it is to be located. Aircraft forgings are presently produced primarily by five manufacturers, the two largest being Wyman-Gordon and Alcoa.

Survey is expected to result in new USAF orders for forging equipment, with greater emphasis being placed on mid-west and West Coast manufacturers.

In line with increasing demands for forgings, USAF's pilot plant at Adrian, Mich., now used principally for research, will soon be converted for production. Some forgings and extrusion research will be continued there, however.

•

New priority system for the granting of rapid tax write-off certificates places the aircraft industry in a highly favorable position. Applications by military aircraft and parts makers are lumped in fifth place with all military end items.

Aviation gasoline plants rate eighth in the priority roster while plants to produce aluminum extrusions for aircraft will be tenth to get attention from DPA. First priority will go to machine tools. Expansion of aluminum facilities landed sixth on the priority list.

•

Limited number of turboprop-powered versions of the T-29 has been ordered from Convair by the USAF. Planes will be fitted with 3,000 horsepower Allison T-38 engines but they will be structurally able to handle more powerful versions of the T-38 when they become available.

Petroleum Administration for Defense, in an attempt to reduce current petroleum deficits from 24,000 barrels a day to 10,000 barrels, has issued two new orders. One boosts tetraethyl lead content of aviation gasoline for commercial planes in the U. S. to 4.0 cubic centimeters per gallon, at the same time upping exported avgas to 4.6 cc's a gallon. Other order prohibits use of alkylate and other blending agents in anything but avgas.

Domestic carriers will not be hurt much by the first order since the average lead content of the gas they use is about 3.6 cc's as against 4.0 under the regulation. But domestic and international carriers who must refuel overseas will face higher costs as a result of the 4.6 cc lead content in their gasoline. Military planes now use the 4.6 cc figure in their fuel, but they do not have to worry as much about costs.

PAD drafted the order without waiting for a study on the problem made by CAA, claiming the acuteness of the "present emergency" made their order necessary immediately.

•

Look for CAB to start investigation looking toward possible merger of Continental Air Lines and Mid-Continent Airlines. Order may be released by time this issue is in the mails.

Also, look for merger application to be filed soon by Empire Air Lines and West Coast Airlines, local service carriers.

•

No-raiding agreement renewed last year by the CIO United Auto Workers and the AFL International Association of Machinists is up for discussion again despite the fact that it is "permanently" in effect.

UAW president Walter P. Reuther and IAM chief Al Hayes have met to discuss the situation in view of industry expansion and decentralization of many plants. No decision was reached on attempts to "steal" union members or take over bargaining rights, but the present agreement will probably be extended in altered form. Some observers think the unions will divide the industry into spheres of influence.

•

Some 20,000 striking UAW-CIO workers, heeding the recommendations of the union's executive board, have returned to their jobs at Wright Aeronautical Corp., Wood-Ridge, N. J., and Douglas Aircraft's Long Beach plant. Six-week Douglas walkout will add $36 million to the cost of C-124's, according to President Donald W. Douglas, while three-week stoppage at Wright is unofficially said to have cost more

than $3.6 million. Negotiations toward settlements continue.

Strike at 10 Borg-Warner Corp. plants continues in defiance of Wage Stabilization Board's return-to-work request. UAW, however, has offered to discuss with defense officials resumption of production of B-W's defense products, including many aircraft parts.

Despite settlement of two major aircraft strikes, aircraft labor picture is still dark. UAW negotiations with Douglas-Tulsa, Ryan, Fairchild and Martin continue, although locals have authorized walkouts at Tulsa and Ryan-San Diego.

Feeling is that the auto workers will be more reluctant to call aircraft strikes in view of Wright and Douglas certifications to WSB.

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Government aircraft production officials are hinting that the industry might be wise to tone down its complaints about difficulties in obtaining materials. Too much griping, they say, might bring about crackdowns on present inventories.

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Half cent boost in Federal gasoline taxes, which becomes effective Nov. 1 under provisions of the new tax law, will cost airlines an estimated $2½ to 3 million more, based on 1951 aviation gasoline purchases.

•

MANUFACTURERS

Prime contractor for a still-classified Grumman-designed plane will be General Motors Corp., which is building a plant at Arlington, Tex., to handle the Navy contract. Plant completion is expected early in 1953.

Modifications of Boeing B-47 bombers will be made by Grand Central Aircraft Co. at Tucson, Ariz. B-47's from Boeing-Wichita, Douglas-Tulsa and Lockheed-Marietta will be funnelled to Tucson for any new engineering changes and post final line developments.

First shipment of completed plane engines from Ford's Chicago plant is expected in March. Plant now has 4,200 of the 6,200 machine tools it requires. About 700 sub-contractors are being used to turn out engine parts.

Layoff of 200 workers has taken place at Bell Aircraft Corp. in a revision of production schedules, but reduction is said to be temporary.

A $60,000,000 loan to finance inventories has been arranged for the Douglas Aircraft Co. by Security-First National Bank of Los Angeles.

Largest military production order for small gas turbine engines has been received by AiResearch Manufacturing Co. Navy orders total $36,000,000. New orders cover engines, gas turbine starters and control valves for seven Navy jet and turboprop planes.

Military plane builders holding A-1 allotment symbols are exempt from an NPA order limiting inventories of aluminum to 45 days. Plane builders may legally continue to have a 60-day supply on hand.

Machine tool problem will be with us for another two years, according to former USAF Under Secretary John A. McCone. He cited increasing shortages of critical materials and aircraft strikes as two other factors controlling progress of the aircraft expansion program.

NPA is thinking of changing aluminum mill schedules to step up production of aluminum bars, rods and forging stock and cutting down sheet output, thus aligning plane and aluminum production. Group's enforcement division is also studying alleged excess aluminum inventories of plane builders to shift present stocks among aircraft manufacturers. Some aircraft aluminum may also be released for civilian production.

Increased construction cost is responsible for Hughes Aircraft Co.'s decision to sell its Tucson, Ariz., electronics plant to the USAF. Hughes had planned to spend $7,000,000 but later estimates placed the cost at $12,000,000.

Improved version of the CF-100 is being planned by Avro Canada, which expects to place it in production late in 1953. It will be known as the CF-103 and will feature swept wings and a super Orenda engine. Avro, meanwhile, is at work on a Mark IV version of the CF-100 which is to make its first flight early next year. The Mark IV will have a more powerful Orenda and improved radar and armament.

Half of Stanley Aviation Corp.'s $3,000,000 backlog consists of orders for new type bail-out seats developed under USAF contracts. Employment of 190 will be increased as firm shifts from research to production.

Hussman Refrigerator Co., St. Louis, has set up an aircraft division to handle manufacture of parts and sub-assemblies. Volume production at the new division will be reached next spring.

DPA Deputy Administrator James F. King, just sworn in, has been made responsible for all activities in the field of tax benefits and direct government loans for plant expansion.

Telford Taylor, New York attorney, has been sworn in as Small Defense Plants Administrator.

•

PLANES AND EQUIPMENT

Production plans for Avro Canada's C-102 Jetliner have been shelved as a result of production contracts for Avro's CF-100 jet fighter and Orenda engine. R. Dixon Speas, U. S. representative for the firm, has resigned because he was disinterested in switching from commercial to military sales. The RCAF, meanwhile, has taken over its first Orenda-powered CF-100.

USAF has confirmed that the Martin Canberra B-57A will be powered by Wright J-65 Sapphire engines.

Device to reduce the humidity of the air introduced into plane cockpits through the air conditioning system has been developed by Boeing for its B-47 bomber. "Gushing Gertie" uses a centrifugal water separator with cyclonic rotor attachment to reduce moisture, and weighs only four pounds. It does not operate at below-freezing temperatures.

Pre-flight checking of jet engines is accomplished by Lockheed on an old jet plane stripped of

(*Continued opposite Page* 62)

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American Aviation

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OCTOBER 29, 1951 • Volume 15 No. 22

New Supersonic Engine Designs Revealed
Afterburners convertible into ramjets 15

Congress May Probe AMC 'Irregularities'
Senate group considers visit to Wright-Patterson 17

Military Spends $50 Million on Simulators
Need causes flight trainer industry expansion 19

Tomorrow's Aircraft Engines
Interview with NACA's Sharp and Silverstein 20

Air Bases: $1 Billion Market for Suppliers
AF, Navy spending heavily on air bases 22

Navy Tries New Stall Warning System
New instrument tested on carrier landings 24

Trend to One-Time Use of Spark Plugs
New spark plug data made available by Champion.. 34

How to Promote Public Use of Airports
Baltimore sets pace in good airport publicity 54

Departments

Airline Commentary	53	In Flight	61
Airport News Digest	55	Index to Advertisers	56
Between the Lines	28	Letters	10
Boedy's Album	59	New Products	45
Editorials	11	Production Spotlight	31
En Route	62	Technical Literature	35
Extra Section	46	Washington View	57
		When & Where	6

other publications

American Aviation Daily (including International Aviation): Published daily except Saturdays, Sundays and holidays. Subscriptions: $16 one month; $180 one year. Daniel S. Wentz II, managing editor.

American Aviation Directory: Published twice a year, spring and fall. Single copy, $7.50. Marion E. Grambow, managing editor.

Official Airline Guide: Monthly publication of airline schedules and fares. Subscriptions: U. S. A. and countries belonging to the Pan American Postal Union, including Spain and the Philippines, $9.00 one year, Canada, $9.50. All other countries, $11.00. Published from editorial offices at 139 North Clark St., Chicago 2, Ill. State 2-2154. C. N. Johnson, managing editor.

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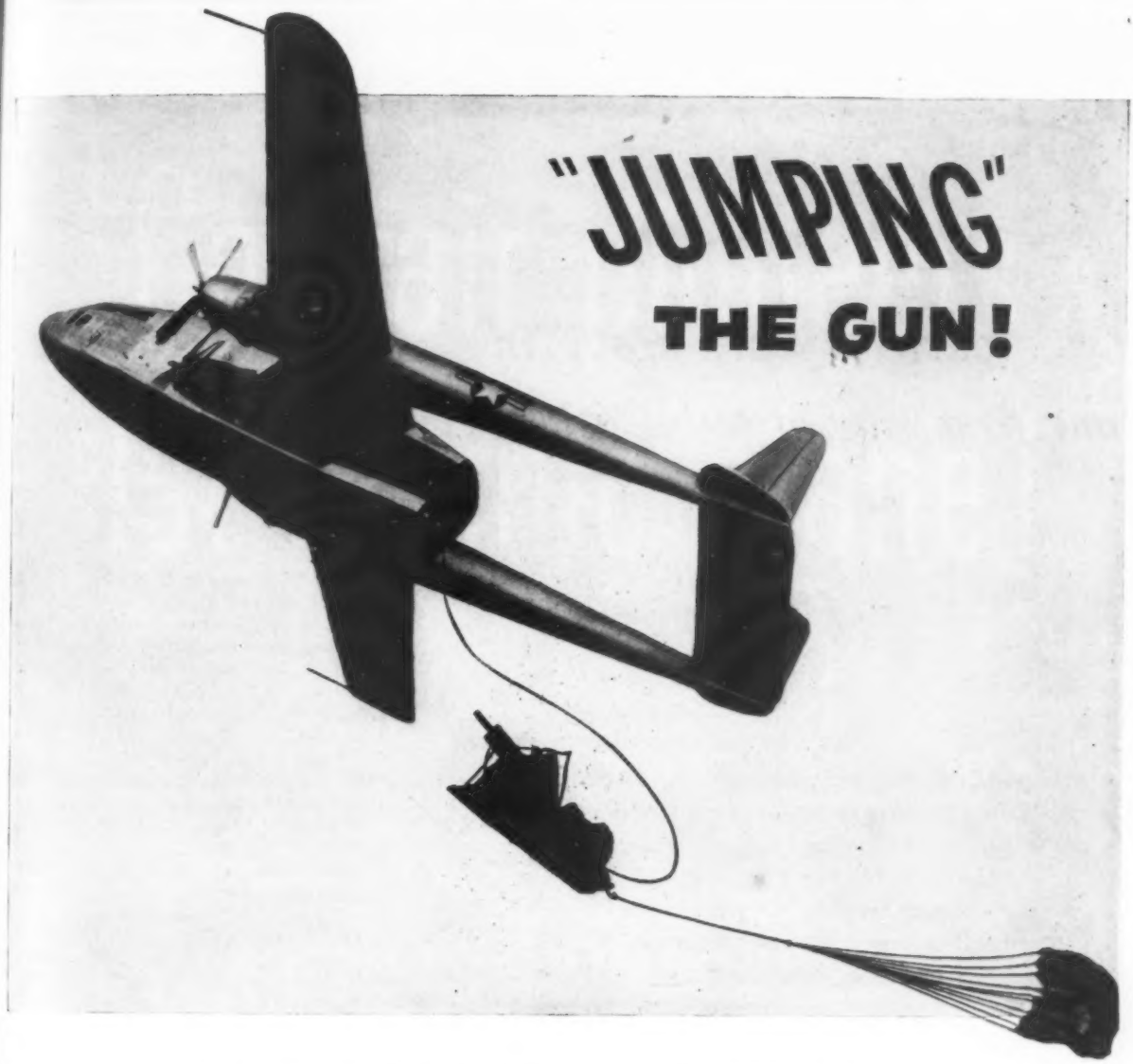

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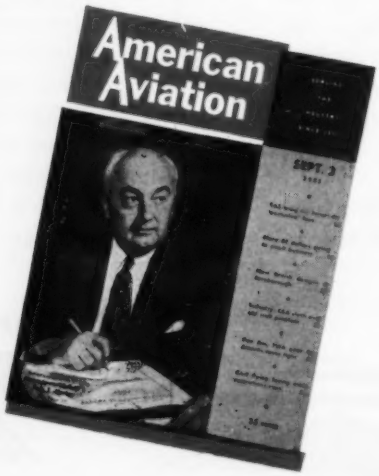

When & Where

Oct. 29-31—Society of Automotive Engineers, Transportation Meeting, Knickerbocker Hotel, Chicago.

Oct. 30-Nov. 1—Air Transport Association, Purchasing Committee, McFadden-Deauville Hotel, Miami Beach, Fla.

Oct. 30-Nov. 16—Fifth Air Transportation Institute, American University, Washington, D. C.

Oct. 31-Nov. 1—Society of Automotive Engineers, Fuels and Lubricants Meeting, Drake Hotel, Chicago.

Nov. 2—Helicopter Council, Aircraft Industries Association, Carlton Hotel, Washington, D. C.

Nov. 6-10—Symposium on Physics & Medicine of Upper Atmosphere, sponsored by Air Force School of Aviation Medicine and Lovelace Foundation, Plaza Hotel, San Antonio, Texas.

Nov. 7—Wings Club annual dinner, Waldorf-Astoria Hotel, New York.

Nov. 8—Washington State Third Annual Aerial Spraying & Dusting Conference, Yakima Municipal Airport, Wash.

Nov. 14-16—National Aviation Trades Association, 12th annual convention, Hotel Texas, Fort Worth.

Nov. 28-30—Aviation Distributors and Manufacturers Association, Annual Winter Meeting, Waldorf-Astoria Hotel, New York.

Nov. 30-Dec. 5—American Society of Mechanical Engineers, Chalfonte Haddon Hall, Atlantic City, N. J.

Dec. 4-5—Transport Aircraft Hydraulic Accessory & System Conference, Sheraton Hotel, Detroit.

Dec. 15—National Aeronautic Association, San Francisco Chapter, "Kitty Hawk Day" Celebration.

Dec. 17—15th Wright Brothers Lecture, U. S. Chamber of Commerce Auditorium, Washington, D. C.

Dec. 17—Wright Memorial Dinner, Statler Hotel, Washington, D. C.

Dec. 17—Air Transport Association, Board Meeting, Carlton Hotel, Washington, D. C.

Dec. 18—Air Transport Association, Annual Membership Meeting, Carlton Hotel, Washington, D. C.

International

Oct. 29-30—Air Industries & Transport Assn. of Canada, Annual General Meeting, Seigniory Club, Montebello, Quebec.

Oct. 30—ICAO, SAM/SAT Regional Meeting, Buenos Aires.

Nov. 20—IATA, Traffic Conferences 1 & 2, Nice, France.

Nov. 21—ICAO, FAL, 3rd session, Buenos Aires.

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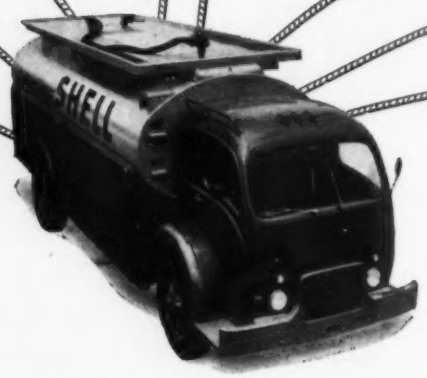

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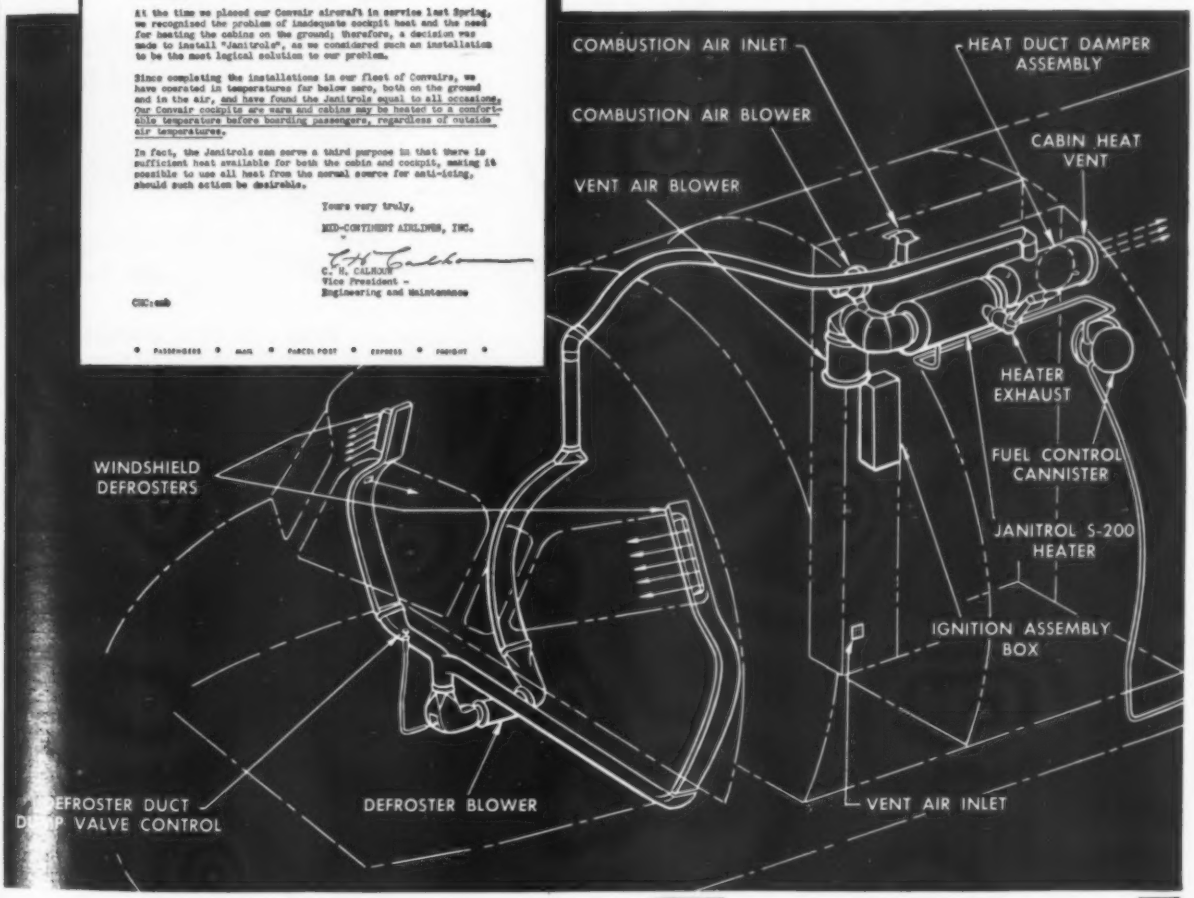

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Letters

Letters should be addressed to The Editor, American Aviation Magazine, 1025 Vermont Ave., N.W., Washington 5, D. C. Anonymous letters will not be printed, but names will be withheld upon request.

From a Wheelchair

To the Editor:

I enjoyed your article on Jack Hoffman of Chicago and Southern in your October 15 issue and thought that you would like to know about Bernard Estrin, a poliomyelitis victim, who works as a reservations agent for TWA in St. Louis.

The enclosed picture shows Estrin "on the belt" as he talks to his supervisor, George Feehan. Seated are June Klipstine and Mildred Long.

From his wheelchair Estrin, who is 30 years old and a World War II veteran, proves everyday that he can perform his job efficiently and calmly.

The air travellers who deal with him are as familiar with his voice as he is with theirs. But the chances are that few, if any, know he is doing his work from a wheelchair.

Estrin came with TWA in 1940 as a cargo handler, later becoming a passenger agent. In 1942 he joined the Navy as Specialist First Class and was shipped to the South Pacific. Returning to TWA in January, 1946 in St. Louis, he was stricken with polio in August of the same year. For a long time he was completely paralyzed.

The National Foundation for Infantile Paralysis and the Veterans Administration joined forces to help him. At a VA hospital he became the "disc jockey" for the hospital's radio network—and soon was a favorite with all the patients.

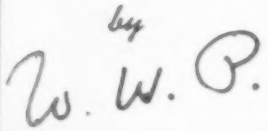
Estrin went to Florida for two years, trying various part-time jobs. Last May, he returned to St. Louis, where he lives

(*Continued on page* 58)

Editorial

Morality in Public Office

SWINGS in ethics and morality in government office seem to go to extremes. Right now the military brass has swung to an absurd extreme in the matter of any military personnel accepting so much as a cigarette from contractors. Air Force officers are afraid to have lunch with industry people because of this new swing of the morality pendulum. It is to be hoped that there will be a little sensible clarification and easement in the near future.



Much is being written today about morality in government circles and the Administration-resisted drive against Communist affiliations is still going on. It will be years before the whole story comes out, but even today there are people in important government positions—including our occupation staff in Germany—whose left-wing tendencies are quite out of sympathy with the traditions of the United States. The infiltration into government by people whose allegiance and sympathies were directly or indirectly toward a foreign power has been a sorry chapter in American history.

Yet we are still overlooking morality lapses by many who consider themselves Americans but whose personal activities are just as much against the public good as the activities of Communists. Take, for example, a man who takes the oath of office as a member of a quasi-judicial or other administrative government agency. Is he any more an American than a Commie party follower if he connives for payment of money or substantial favors to throw his complete influence behind a particular case or interest? Is his defection from morality any less deep if the payments go to a third party, at least for the time being, through legal retainers or some other method by which his decision or vote or influence is committed?

The American way has been undermined in many ways. Dupes and willing subservients to the cause of a foreign power constitute one. Outright criminal violation is another. But so, too, we have those with pious outward appearance whose souls, spirit, influence and votes have been sold to special interests regardless of oaths of office or the public good. There is no such thing as half-way honesty or half-way Americanism and those who provide the money, third-party retainers or favors are contributing just as much to breakdown of public morality as those who are the recipients.

Both Doing Okay

WE'RE frequently asked how the CAB and the CAA are doing these days.

From our observation post, CAB Chairman Donald Nyrop is doing a first class job. He's one of the hardest-working chairmen the CAB ever had. He takes his job seriously. Anyone can delegate the work and the thinking to the staff—but this is no substitute for doing the thinking yourself. And new member Chan Gurney is showing up well as one who never accepts a statement without knowing the reasons why. He is an independent thinker.

As for CAA, Charles Horne is a first class administrator. He has an appealing frankness and good follow-through. He'll tackle any problem at the drop of a hat. He has been tireless in getting around the field.

Never have CAA and CAB worked more closely and smoothly together. There's a lot of know-how available. Neither CAB nor CAA can keep everybody happy all the time, but despite some well-known weak spots both agencies are doing okay.

Bus Competition

CRITICS of local service airlines frequently point out that intercity bus service is cheap, frequent and fast, and therefore offers unbeatable competition for the airplane.

It isn't necessarily so. Bus service is much cheaper than air, but it isn't very fast. A few months ago *Mass Transportation*, the magazine of the transit industry published in Chicago, carried an article on Ozark Air Lines, under the title "Will 'Air Taxi' Service Skim Cream off Bus Business?" The figures given for bus operations were somewhat startling.

For example, a bus line operating between Peoria and Bloomington, two Illinois cities only 47 miles apart, takes one hour and 50 minutes, while Ozark's flying time is 28 minutes. Even with taxi to and from the airport, and check-in time, the airplane is much faster, although the fare is $2.50 plus tax by air as against 90c by bus.

The magazine said a check of intercity bus schedules shows running times of from 90 to 180 minutes for runs between cities of about 50 miles apart. The local service carriers have never claimed that there is a big potential in carrying passengers from one stop to the next when the stops are only 50 miles apart. That isn't why local service airlines were established. Their chief value is in providing longer hauls and connecting service between metropolitan areas and smaller communities. But if intercity bus schedules are as slow as depicted (probably due to the many small intermediate stops and heavy highway and city traffic), the local service airline shows up surprisingly well.

What *Mass Transportation* was pointing out is that helicopters which would land in the heart of cities would begin to offer bus companies really great competition even with a marked fare differential. Local service carriers like Ozark are pioneering in more ways than one. They are tapping a type of market never before served by trunk lines. Perhaps the bus isn't as formidable a competitor as many had assumed.

WAYNE W. PARRISH

IN THE NEWS

G-E FLIGHT TEST CENTER FINDS ANSWERS IN THE SKY

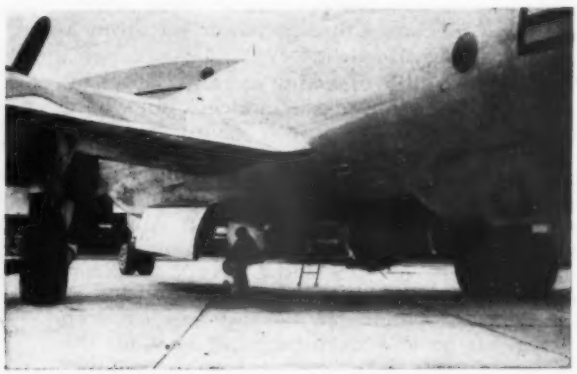
One of the biggest current programs, is an accelerated service test of G-E J47 engines in a North American B-45C, for the Air Force. This B-45 is one of the newest planes to join the Flight Test fleet.

A sure way to test airborne equipment is in the air. So General Electric has established an invisible laboratory that stretches eight miles up into the sky.

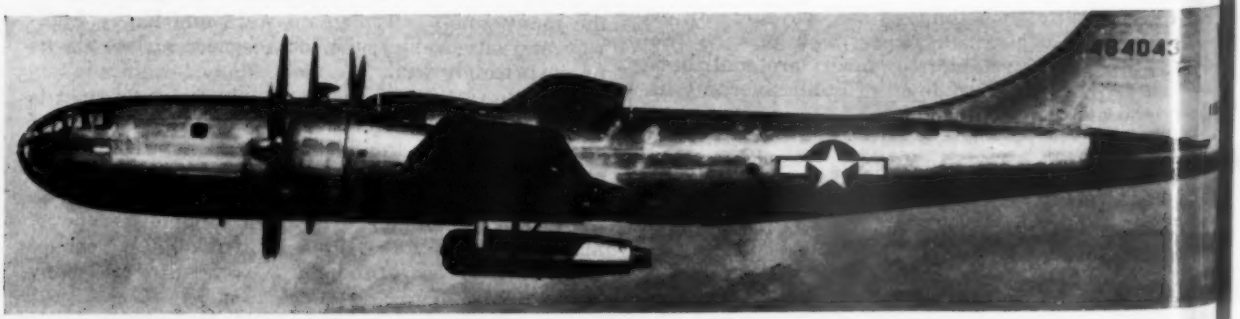
At the bottom of this lab is the G-E Flight Test Center at the Schenectady, N. Y. County Airport. Here, a "private air force" is put through its paces with new and improved aircraft equipment. A division of the Company's General Engineering Laboratory, the Flight Test Center is devoted entirely to testing General Electric aviation equipment *in the air*.

G-E's program of designing, testing, redesigning, retesting means better, more reliable equipment for you.

Ed Haven, left, now manager of G-E's Aviation Divisions, beside G-E's first airplane, back in 1930. Prior to this purchase, equipment was tested in a monoplane rented for a dollar a minute. Foresight of men like Haven made possible the extensive facilities now in use.



New engines and components are tested thoroughly while slung from the bomb bay of a B-29. Here a J47-GE-23, powerful new jet recently placed in production, is made ready in the Flying Test Bed. New engine control, anti-icing, and ignition systems were first proved and improved in this plane.



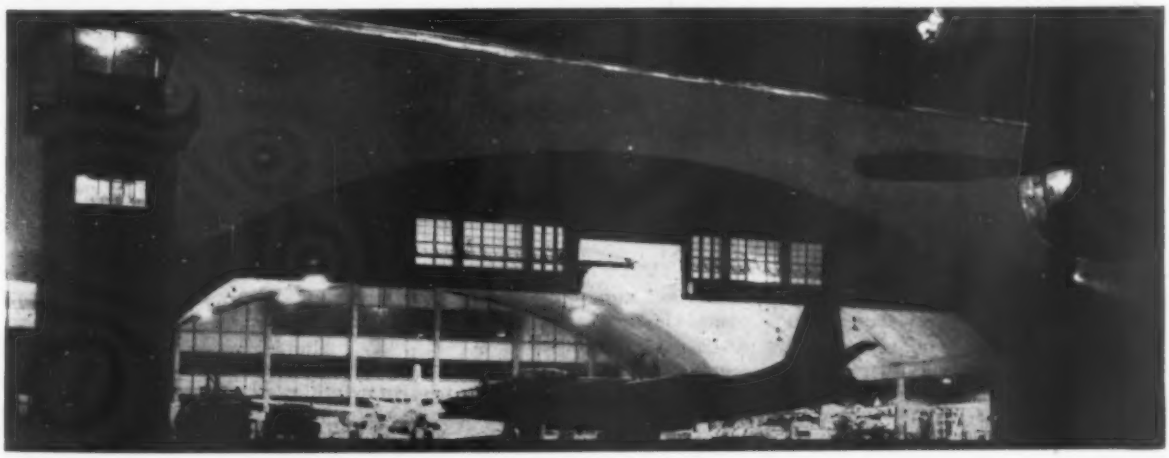
A B-29 is pushed along by a standard J47, specially instrumented for test work. Many engine features and pilot techniques first checked out here, are now being combat-proved in Korea. American Airlines crews, under contract to G-E, perform all flight operations.

Long distance wires and radio-telephones keep engineers in G-E's Aircraft Gas Turbine Divisions in Lynn, Mass., in contact with the crew in the test plane. Weldon Orme, at the Test Center, talks to Lynn (200 miles east) with the phone in his left hand, and the B-29 (eight miles up) with the phone in his right hand.

Special instrument panels in test aircraft are photographed four times per second. Cameras and instrument panels were specially designed for this purpose. After each flight the films are studied minutely to gain all possible information on operation of the engines.

Many types of aircraft are used. This B-23 tested high-altitude turbosuperchargers during the war. Cabin pressurizing from turbos, developed on this plane, is now in use on many military craft as well as on some commercial transports.

One of many projects at the Center has been a jet powerplant for a developmental helicopter. A 150-foot bowl served as a test pit for "Operation Skyhook." Ramjet, pulsejet, and turbojet engines are tested here.

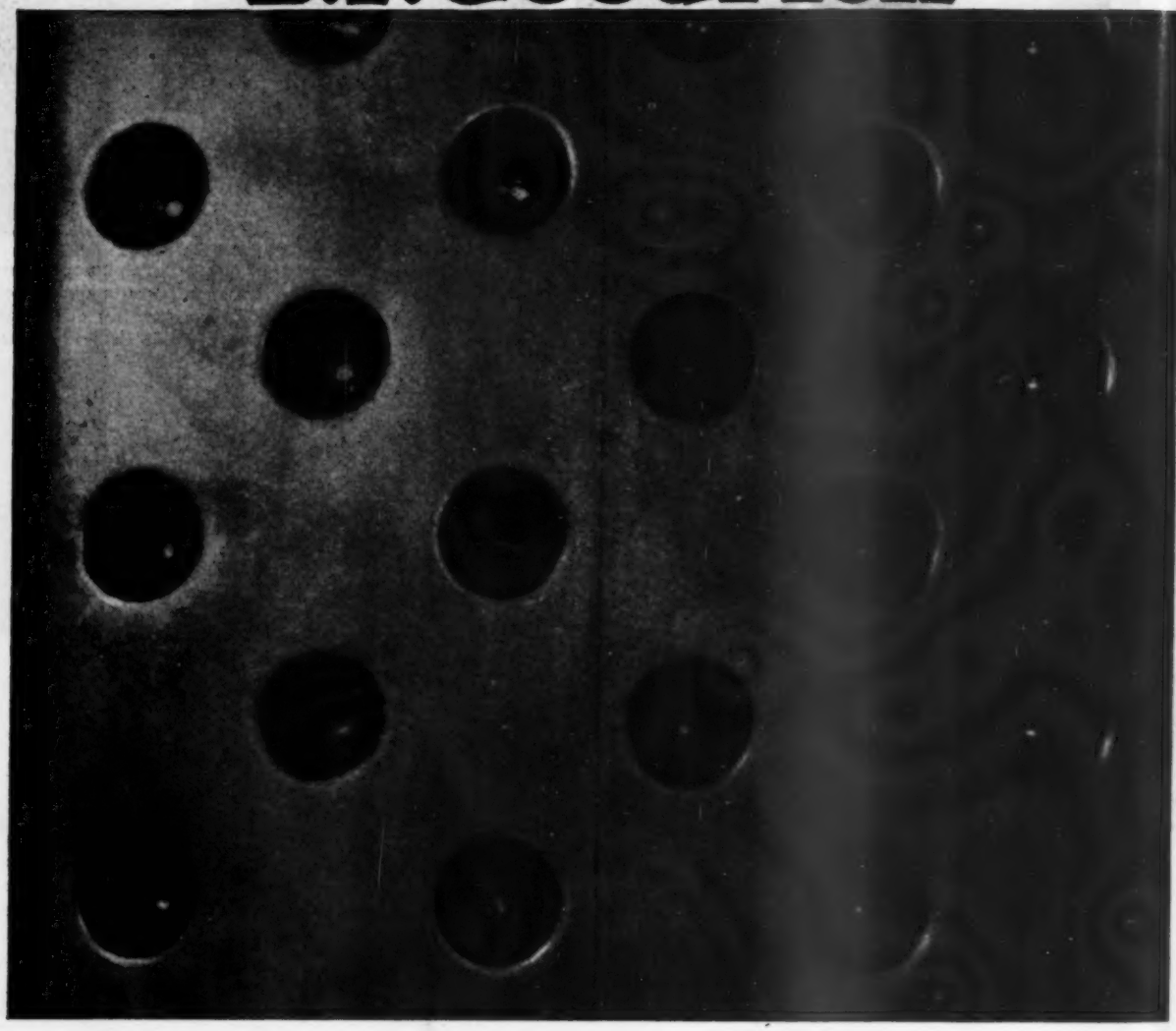


The G-E stable of planes includes many loaned by the government as well as Company-owned craft. Closely guarded, the Flight Test Center tests armament, instruments, autopilots, radar, electronics and communications equipment, electrical systems, and other aircraft equipment, in addition to aircraft powerplants.

GENERAL ELECTRIC

210-24

B.F.Goodrich



New kind of tire outwears all others in airline tests

AIRLINES who have used a new B. F. Goodrich tire in actual service have now reported it outwears all other tires they have used.

It has a new kind of tread design with round, dimple-like indentations in the rubber. The dimple indentations provide better distribution of the tire load and reduce exposure to tread cutting. The tread design is a complete departure from conventional ribbed treads.

A typical report from an airline using DC-3 equipment: "We removed the tires after 400 hours, 1200 landings. In the process of recapping, we discovered that there was enough rubber left for about 100 hours more, a total of 1500 landings. These tires have given us longer service than any we have used."

Some of the airlines that tested the new tires and are now using them as standard equipment are Braniff, United, American, Continental, Frontier, West Coast and National. Others are beginning to make the switch.

Tooling up for production of the new tire in four additional sizes is now underway at B. F. Goodrich. The new, longer wearing B. F. Goodrich tire is the latest "first" in aviation tires from B. F. Goodrich, leader in rubber research and engineering. *The B F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

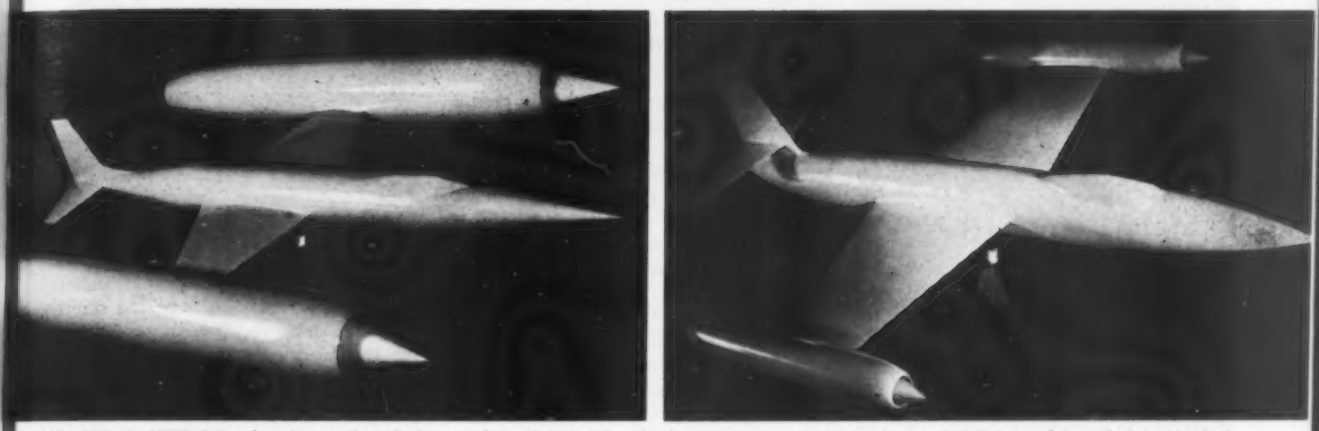
B.F.Goodrich

FIRST IN RUBBER

ESTABLISHED JUNE 1, 1937

American Aviation

VOLUME 15 NUMBER 22



RELATIVE MERITS of unboosted turbojets and engines with afterburners are emphasized by NACA models of hypothetical 1350-mile per hour planes. With afterburners (right), engine size is virtually halved.

New Supersonic Engine Designs Revealed

NACA may use afterburners as ramjets; discloses power increases, new blade cooling.

By WILLIAM D. PERREAULT

SUPERSONIC aircraft and missiles of future years will probably be powered by a combination turbojet engine with afterburner that can be readily converted to ramjet operation in flight.

This is one of the important conclusions that can be drawn from work now underway at the Lewis Flight Propulsion Laboratory in Cleveland, O., center of aircraft engine research under the direction of the National Advisory Committee for Aeronautics.

Many promising developments, particularly those aimed at increasing the output of current turbine engine designs while permitting a reduction in the amount of strategic materials required in engine production, were disclosed as NACA opened its laboratory for three days so that some 1,500 industry and government representatives could review recent progress in the engine field.

Among these disclosures:

- **A system of turbine blade cooling** which will virtually eliminate the need for columbium, cobalt and tungsten in the turbine disc and blades.
- **Application of transonic compressors** at the inlet stage of the turbojet engine which can raise airflow by 30% and power output proportionately.
- **Testing of turbojet engines** in NACA's 8 x 6 supersonic tunnel at altitude up to 65,000 feet and speeds up to Mach 2.
- **A new $34 million supersonic tunnel** which goes into operation in 1954. Here ramjet engines rated well in excess of 100,000 pounds thrust can be tested at speeds up to Mach 3.5.
- **New developments in tool design** have made it possible to reduce manufacturing time of experimental turbine blade designs from about eight months to as little as three weeks.
- **Electronic digital computers** in which master templates, used to control small scale production, are machined automatically from design data fed into computers and controlling machine operation.

Ramjets Stressed

Ramjet engines and related problems of supersonic speeds and high altitude operation are occupying a sizable portion of NACA's attention, with turbojets, turboprops and rockets also high on the priority list but with piston engines virtually excluded. Ramjet engine research is apparently tied in closely with NACA's Pilotless Aircraft Division at Wallops Island, Va., where research engines are used to power flight models.

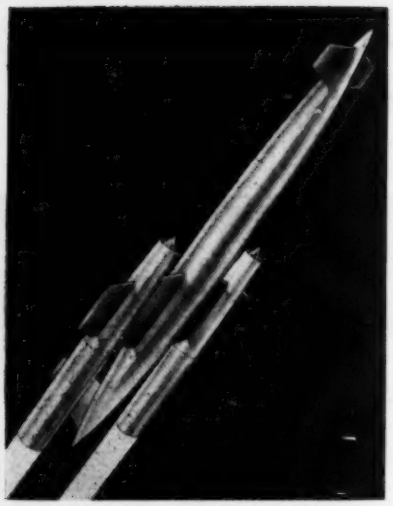
NACA officials released photos and data showing the necessity for afterburners in supersonic aircraft applications (see cuts). These show that unboosted turbojet engines driving a hypothetical airplane at 1,350 mph would have to be about twice the size of turbojet engines with afterburners capable of the same performance. At these high speeds airplane drag increases so rapidly that the turbojet will not do the job effectively unaided.

If the turbojet with afterburner is used, an interesting possibility arises. At speeds slightly above the speed of sound, the ramjet engine comes into its own. The similarity between turbojet afterburners and ramjet engines lends itself to dual purpose installations.

The afterburner is a simple tubular duct mounted aft of the jet engine's turbine assembly. Provisions are made in this extended tailpipe section to spray additional fuel into the exhaust gases to combine with unburned air to provide additional thrust.

Because afterburner fuel consumption runs at least 2.5 times that of the basic engine per unit of thrust generated, however, it becomes an inefficient method of providing thrust. Truly efficient burning requires compression of gases, which is not possible in an exhaust pipe.

The ramjet engine, although little more than an afterburner, is used by itself, that is, independent of a regular turbine engine. The turbine engine relies on complex mechanical compressors and the turbine assembly to compress air for burning. Many of the engine's limitations are associated with



ALTERNATE CHOICE of engine installations in ramjet-powered missile, and the best location because of multi-engine requirements, is shown in this flight model. Major problem is presented by turbulent flow from bowplane which shifts below, on center and above the engine inlet in varying angles of attack.

these portions of the engine.

In the ramjet engine, on the other hand, compression is achieved solely by the ram effect of high forward speeds on air passing through the tubular engine assembly. With no mechanical compressors or temperature-sensitive turbine assembly, it is an extremely simple unit of low cost and high thrust potential. Its obvious shortcoming is that it must be operated at speeds well above Mach 1 before sufficient ram exists to make it an efficient unit.

At present, ramjet engines are used experimentally in applications where initial speed is attained by use of booster rockets, or in jet fighters once high speed has been attained by conventional methods. NACA established that unboosted turbojet engines are not efficient for supersonic speeds. Turbojets with afterburners, however, are quite satisfactory. A turbojet engine which has pushed an aircraft into the transonic speed range could use the afterburner to pass the speed of sound.

Turbine Bypassed

Once the aircraft or missile attains an efficient operating speed for ramjet engine operation, the turbine engine assembly might be bypassed and the afterburner used as a straight ramjet unit. Ducting and related ram losses present formidable problems. Speeds of Mach 2.5 might be required for efficient operation. Developments in this line should be well worth watching.

Of more immediate importance is the turbine cooling program. Many proposals have been offered for turbine blade cooling, including self-circulating liquid systems and various air systems. These have been so complex or impractical that manufacturers turned instead to the use of strategic metals which will withstand the heat. Result has been that some 97% of the materials in current high-powered jet engine turbine blades are columbium, cobalt or tungsten.

NACA has now designed, and engine manufacturers are experimentally testing, a system of turbine disc and blade cooling which will cut blade temperatures virtually in half and cut strategic metal content of turbines from 97% to about 3%. Such a reduction is mandatory if high-volume engine production in keeping with the mobilization program is to be achieved.

NACA's turbine cooling design features hollow turbine blades filled with small tubes brazed to the outer shell (see photo). Air is bled from the engine compressor, routed externally of the engine to the tail pipe area and then through specially insulated ducts through the exhaust gases and into the shaft which carries it into the turbine disc and individual blades.

Using .03% of total engine air output for cooling, this system is capable of dropping turbine blade temperature by 550-600 degrees Fahrenheit. NACA has conducted tests with varying amounts of air, from .01 to .05% of engine output, but .03% appears to be most productive.

40% Boost

NACA's Abe Silverstein, chief of research at the engine facility, said that practical improvements in jet engine design already proved but not yet applied to production engines will permit boosting engine thrust by about 40%. A current engine rated at 5,000 pounds thrust could readily be raised to 7,000 pounds thrust. The use of transonic compressors at the inlet stage of an axial flow compressor, for instance, could up airflow through the engine by 30%, providing much higher thrust.

Some five tons of air per minute are needed to satisfy the turbine engine's appetite. Transonic compressors will help provide this air. Supersonic compressors will make it possible to get as much as six times ordinary sea level air pressure in a single stage. This will make possible engines of shorter overall length and possibly of smaller diameters.

Compressor research now gets major attention at NACA, but as recently as a year ago, compressor and turbine research was hampered by the long lags between conception of new design and completion of test models, approximately eight months being standard. New tooling and machine methods have cut this to as little as three months. NACA's research in this field will benefit all U. S. industries.

NACA has put digital computers to work operating milling machines and other shop tools used in fabricating master templates (patterns) with which the small batches of test turbine or compressor blades are produced. As presently used, an electronic "eye" follows the airfoil blade shape and computers transform the resulting traces to machine operation which cut the required template.

Pattern Eliminated

Work is now underway which will eliminate drawing the initial pattern. Instead design data will be fed directly into the computers which will operate the machine tools and cut master templates. The machines which use the master templates to cut actual production blades are equally fantastic.

Many of the instrumentation tasks faced by NACA are unique in the history of man. Consequently NACA researchers spend much time and effort in designing means of recording temperatures, pressures and other data which are required to verify test results. For instance, NACA scientists have had to develop a fast-acting thermocouple capable of measuring 4,000 degrees Fahrenheit. Platinum, often used in high temperature thermocouples, has a limit of 3,000 degrees. NACA designed an internally air-cooled thermocouple in which cooling caused a temperature gradient which could be accurately translated into equivalent temperatures.

COOLING AIR ducted through small tubes within the turbine blade cut operating temperatures by about 550° F. Air for cooling is bled from the engine compressor and represents about .03% of compressor output.

TEMCO T-35 BUCKAROO military trainer is now loaded for bear. Visible under the wings are ten 2.75-inch rockets. Weighing 1975 pounds fully loaded, Buckaroo also carries two .30 cal. machine guns, electric gun sight, and a 16 mm. gun camera.

PROTOTYPE of the 44-passenger Convair-Liner 340 took off on its initial flight earlier this month. More than 100 of the new high-speed transports have been ordered by domestic and foreign airlines.

Congress May Probe AMC 'Irregularities'

Senate group considers visit to Wright-Patterson; Gen. Rawlings starts procurement 'reform.'

Dayton, Ohio—What started as a seemingly innocuous ruling on the activities of manufacturers' representatives doing business with the Air Force procurement division here is shaping up into what may become one of the top government purchasing investigations of the year.

Latest development in the procurement "reform" movement at Wright-Patterson Air Force Base and the Air Materiel Command involves putting the blame on the Justice Department for news blackouts.

The Air Force had refused to release the names of firms allegedly involved in procurement irregularities, with both Air Force headquarters and AMC claiming the orders to withhold identification came from the Justice Department. It is known that about a score of suppliers have had contracts cancelled for claimed "irregularities."

Attorney General J. Howard McGrath, queried by *The Dayton Daily News*, said that the Justice Department does not disclose the names of companies under investigation, adding:

"But at the same time we do not take upon ourselves the responsibility of advising another government agency as to what it shall disclose. In this instance we definitely have not done so."

Irregularities in procurement activities at the Air Force purchasing center here, both from the standpoint of employes, officers and manufacturers' representatives were first hinted at in mid-September.

Gratuities Banned

At that time the Air Force started the practice of requiring each manufacturer's representative entering the air base on government business to sign a paper specifying that he would not tempt buyers with any gifts or gratuities.

Those who refuse to sign are barred from entering the base.

(*For comment on the gratuity ban, see Between the Lines, page* 28).

At the same time large posters were placed on display at spots all over the procurement offices, warning procurement personnel of the penalty for accepting gifts from any source doing business with the Air Force. Top penalty is $10,000 or imprisonment for two years or both—and dismissal.

Why the sudden act on Air Force procurement?

The ruling followed the arrival of Lt. Gen. E. W. Rawlings at Wright-Patterson to take over as head of the AMC. Gen. Rawlings, one time comptroller-general, replaced Gen. B. W. Chidlaw, now head of the Air Defense Command.

At the same time the OSI was winding up a stay of several weeks at the Air Force base—weeks now known to have been spent in investigation of alleged procurement irregularities.

Probing revealed that in testimony before a Senate committee last August, Col. D. L. Redd, of the AMC procurement division, reported there had been two or three cases of "improper conduct" at the air base.

This "improper conduct" turned out to be the firing of an $8400 a year contractural specialist and suspension for six months of a $10,000 a year industrial specialist. Both had been charged with accepting gifts from contractors.

Congressional sources indicate that the Senate Military Preparedness Committee, under Sen. Lyndon Johnson (D., Tex.), may visit Wright-Patterson dur-

ing Congressional adjournment to look into AF procurement matters with a view to deciding whether a full-scale investigation is needed.

Five more names were added to the list in late September when cases involving four procurement employes and a contractor's representative were revealed. Names of those involved were withheld at the outset, but three names were released later.

The civilians involved were an employe in the Aero-Medical Laboratory at the base who was engaged in the purchasing of survival equipment; a buyer of electronic equipment, a supervisor in the Aero-Medical Laboratory and a second electronics buyer.

All four civilians resigned and the manufacturer for whom the agent was working had his contract cancelled.

With regard to the survival equipment irregularity, it was charged that on one contract alone the firm which the employe was aiding had benefitted through 57 separate deviations (substitutes of one item for another on a purchase request.)

Concurrent with the release of this information Gen. Rawlings — in a lengthy note—cautioned all employes and contractors' representatives against fraudulent procurement practices. He followed this up later with a letter to 4800 manufacturers all over the United States asking that all phases of procurement be conducted within both the letter and spirit of the law.

On October 4 two manufacturers' representatives were temporarily barred from the base. Both were barred for alleged irregularities in their activities with the Air Force buying agency.

Further action is expected but has not developed, with AMC playing its cards close to the table in tune with directives from Washington.

What Gen. Rawlings Told Contractors

Office of the Commanding General

HEADQUARTERS
AIR MATERIEL COMMAND

Wright-Patterson Air Force Base
Dayton, O.
4 October 1951

(Company)
(Street Address)
(City and State)

Attn: President

Dear Sir:

It has always been the firm desire of the Air Force and of the Air Materiel Command that all phases of Air Force procurement be conducted in accordance with both the letter and the spirit of the law, with the strictest honesty and without favoritism or discrimination. Air Force procurement personnel, both military and civilian, are cognizant of the stringent laws and regulations relating to procurement and of their personal responsibilities as representatives of the Government.

The Congress is currently considering the Department of Defense Appropriations Act, 1952. The Senate has proposed an amendment relating to the offering of gratuities which I believe to be generally representative of Congressional feeling on the subject. Because the Senate amendment is of prime interest to all prospective Government contractors, I quote it in full in the inclosure hereto.

In view of the wholehearted cooperation that Industry has extended the Air Force in the past, I am taking the liberty of requesting that you call to the attention of the appropriate personnel of your organization the context of the Senate's proposed amendment to the Appropriations Act and the desire of this Command to conduct its business in accordance with public law and congressional policy.

Sincerely yours,
(Sig.)
E. W. RAWLINGS
Lieutenant General, USAF
Commanding

Incl:
Proposed Amendment

Colonial Makes Changes Under New Management

Luxury offices, a Bermuda beach home, a cook-butler and a maid are among expense items dropped by Colonial Airlines' new management to improve "efficiency and economy."

When CAB dropped its economic probe of the airline last June, following a number of charges made against the company and Sigmund Janas, Sr., former president, Colonial promised to take remedial action. It has now told CAB that:

No longer with the company are Mr. Janas, his wife, Sigmund Janas, Jr., and A. M. Hudson, former vice president. Mrs. Janas, Sr. "appeared on the payroll as K. Hamilton and . . . was paid $1,800 per year." Petty cash account averaging $300 monthly "had been handled by Mrs. Janas."

"Luxury offices" in New York, costing $10,880 a year, have been released for rental to another party. They were "utilized by Sigmund Janas, Sr."

Colonial will no longer pay any expenses on "Connecticut Ave. apartment in Washington, D. C., previously rented by Sigmund Janas, Sr."

No more payments will be made on Bermuda beach home, known as "Rock Morrell," rented by Mr. Janas, Sr. "Groceries, servants, household expenses and miscellaneous expenses had been . . . paid by Colonial."

Removed from payroll was Olga Hutchinson, whose $2,000 salary as maid at Rock Merrell was allegedly charged against "passenger service."

A $3,120-a-year cook-butler, "carried on the payroll as handyman," was removed.

Contract was canceled between Colonial and Rideau Transportation Services Ltd., and all Rideau employes engaged in normal airline activity were transferred to Colonial's payroll. Canceled contract called for $1,000 per mo. management fee for Rideau plus expenses.

Contract is being canceled between Colonial and Bermuda Airways Ltd. Colonial pays Bermuda's expenses, plus $600 per mo. management fee and 26c for each passenger in excess of 2,400 a month.

No more payments will be made to Daniel Gleich for the performance of any services upon the basis of a letter from Sigmund Janas, Sr. Letter "purported to authorize payment of $1,000 a month to Mr. Gleich. . . . It is alleged . . . that the services to be performed related to 'stockholder relations.'"

Colonial said it believes it has "effectively eliminated the possibility that any company funds will, in the future, be used to purchase such items for personal use as boats, motor bikes, automobiles and jewelry . . ."

FLIGHT SIMULATORS, like this Link version of Navy's SNJ, are in for big production.

$50 Million Earmarked for Simulators

AF, Navy demands exceed production as more companies enter growing field.

THE U. S. Air Force and Navy will spend about $50 million on flight simulators during fiscal 1952, an AMERICAN AVIATION survey shows, with about $10 million of this business for the Navy and the remainder Air Force. Flight simulators have become big business.

The flight simulator is remotely allied to the original Link trainers of World War II. The original Link units, however, were basically instrument trainers with no attempt to duplicate the functions of a plane. The present flight simulators have the identical performance characteristics of the production plane.

The pilot has to set engine rpm, manifold pressure, etc.; he hears the engines and must keep them synchronized; every switch, control and instrument is identical to that of the plane. Veteran pilots have been known to break out with perspiration when the instructor introduced emergency conditions into the controls of the realistic simulators.

Demand High

Demand for simulators to meet the Air Force and Navy mushrooming training needs is now greater than current production facilities can handle and both services are looking around at alternate sources.

At present, it takes about 13 to 18 months to get delivery on production units and production is still in its infancy. Indications are that one or more large radio manufacturers, not normally dealing in aviation business, will be called in.

Four major companies are now producing simulators for both services. These are Link Aviation Corp., Binghamton, N. Y., Engineering Research Corp., Riverdale, Md., Curtiss-Wright Propeller Division, Wood Ridge, N. J., and Goodyear. Goodyear is only working on the Navy's ZP4K blimp simulator.

Training Standards

First of the USAF's production simulators was delivered on Sept. 21 and training was initiated early in October at Walker Air Force Base. This was one of two Boeing B-50 simulators on order from Curtiss-Wright and will be used initially to set up basic standards of training, combining simulator and flight time to improve training while sharply cutting the expenditure of time and money.

The Navy pioneered in flight simulator design during World War II and actually perfected simulators for several flying boats. After the war Pan American World Airways contracted with Curtiss-Wright's Propeller Division for a flight simulator of the Boeing B-377 Stratocruiser. PAA's experience with the Stratocruiser simulator attracted worldwide attention and, Air Force officials say, was the basis for the present Air Force program.

Pan American was able to cut average flight time in the airplane during aircraft familiarization training from 12.6 hours to 4.02 hours, and in doing so improved the quality and uniformity of training. PAA's figures showed that, with 20 Stratocruisers, recurring flight crew training costs could be cut by $175,000 per year.

Current production simulators cost an average of about $450-500,000 with costs going as low as $275,000 for simulators for basic trainers. This does not include engineering development costs, which range from $350,000 to one million dollars for the large bombers and transport types. Since the largest number of simulators of one type yet ordered was only 27, this development cost raises individual costs much higher.

Detailed AF Specs

Basically the U. S. Air Force and Navy simulators are the same; however, the USAF has adopted the policy of preparing specifications for their units in much more detail than the Navy. End results are the same, since performance is exactly the same as the production airplane simulated.

Another basic difference in policy involves the packaging of the simulator. Virtually all the Navy units have been built into large trailer trucks so they can be transported from point to point. The Air Force units now in production all call for fixed installations. Some future USAF installations will be of the trailer-type.

Simulators on Order

Engineering Research Corp.

18	North American F-86's
2	Douglas AD-5's
4	Grumman F9F-2's
4	Douglas F3D-1's
4	Grumman F9F-5's
NA	Lockheed P2V-5's
NA	Martin P5M's

Link Aviation Corporation

9	Boeing B-47's
23	Northrop F-89's
27	North American SNJ-5's
NA	Douglas F3D's

Goodyear Aircraft Company

NA	Goodyear ZPK4's

Curtiss-Wright Propeller Division

2	Boeing B-50's
1	McDonnell F2H-1
NA	Convair B-36's
NA	Boeing C-97's
NA	Fairchild C-119's
NA	Douglas C-124's
NA	Douglas A2D's

NA—Not Available.

Interview——**DR. EDWARD R. SHARP,** ***Director***——

ABE SILVERSTEIN, ***Chief of Research***

NACA's Lewis Flight Propulsion Laboratory

In the late thirties, with a possible war as impetus, the National Advisory Committee for Aeronautics decided that a new laboratory devoted solely to research in the flight propulsion field was required to relieve the growing pressure on Langley Aeronautical Laboratory. Accordingly, what is now known as Lewis Flight Propulsion Laboratory was created at Cleveland, O. in the spring of 1942. The newest of NACA's three research facilities (the others are Langley at Hampton, Va. and Ames Aeronautical Laboratory at Moffett Field, Calif.), Lewis now has 2,500 employes, 74 buildings and complete research facilities, including the world's largest supersonic wind tunnel.

Director of the laboratory since June, 1947, is Dr. Edward Raymond Sharp, whose continuous association with aeronautical research began in 1922, when he became NACA's 54th employe at Langley. He served at Langley until 1940, when he was transferred to Moffett Field to supervise the building program for the Ames laboratory. In 1941 he was recalled to Langley to organize the planning for the then-forthcoming flight propulsion laboratory and was later appointed construction administrator.

Sharp's right-hand man is chief of research Abe Silverstein, considered one of the keenest minds in the flight propulsion field. A graduate of Rose Polytechnic Institute, he joined NACA in 1929 at Langley and was named head of the Full Scale Wind Tunnel there in 1940, serving in that capacity until 1943, when he became chief of the Engine Installation Research Division at Lewis. In 1945 he was named chief of the newly formed Wind Tunnel and Flight Research Division at Lewis and in 1949 he was promoted to his present position.

Tomorrow's Aircraft Engines

Q. Dr. Sharp, are current appropriations sufficient to carry on your work at Lewis on the scale you think is necessary?

A. (Sharp) The military research and development program has been expanded about threefold, but to date the funds and manpower authorized for the NACA have not been maintained in balance with the expanded military effort. We feel that a great acceleration of our research is called for. It might be that an even larger increase in our work would be appropriate to the needs of the expanded military program, but this is impossible at the present time because of the proposed saturation use of critical research facilities and a shortage of technical manpower.

Work on Atom Engine

Q. Is Lewis working on the atomic aircraft engine project?

A. (Silverstein) Yes, the know-how of NACA scientists in the fields of heat transfer, materials and basic physics of solids is presently being applied in the nuclear propulsion field.

Q. Mr. Silverstein, you said that your new large supersonic wind tunnel now under construction would be capable of testing engines with thrust ratings up to 100,000 pounds. Will there actually be available, in the foreseeable future, engines of that power capacity?

A. (Silverstein) Yes, these thrusts will be available from engines traveling at high supersonic speeds.

Q. What type of power plant will produce that power?

A. (Silverstein) Either the ramjet or the rocket engine.

Q. When will the new tunnel actually be in operation?

A. (Sharp) Just as soon as our suppliers can provide the motors, all the complicated electrical equipment and the other components of the tunnel. The target date is 1954.

Q. Is Lewis Laboratory doing work on improving the efficiency of light aircraft engines, or those for personal planes?

A. (Silverstein) No. The background of research that NACA has accumulated over the years in the development of reciprocating engines is adequate for development of new lightplane engines by the manufacturers.

Q. Are you doing any work at all on piston engines, such as compound engines?

A. (Silverstein) No. NACA completed its work on compound engines three years ago and no further work is being done on reciprocating engines of any type.

Q. When we first started talking about turboprop engines, they were generally regarded as power plants for the 400-500 miles-per-hour speed range. Has your research indicated that new developments in the turboprop field have raised the limits of the engine?

A. (Silverstein) Yes. Supersonic propeller developments have raised the limits of the turboprop to the transonic speed range. The NACA laboratories at Langley Air Force Base and at Moffett are conducting research on supersonic propellers and propeller manufacturers are working with them.

Q. There is considerable interest in the U. S. in the French Turbomeca Aspin engine, which has the ducted fan turbine and reportedly a very low rate of fuel consumption. What is NACA's attitude toward this type of power plant?

A. (Silverstein) The ducted fan engine has a fuel consumption rate lower than that of the turbojet engine but

"Ramjet . . . is more economical than an auto engine . . ."

higher than that of the turboprop. It is an engine that can be applied most efficiently in the 500-600 miles-per-hour speed range. We are definitely interested in the ducted fan.

Q. Are there new developments in the field of compressors for turbine engines?

A. (Silverstein) We're making rapid progress in developing compressors of higher compression ratio and higher airflow per unit of cross section area. These compressors are in the advanced research stage and involve use of transonic and supersonic blading.

Q. Does this involve higher temperatures and new metals?

A. (Silverstein) The compressor developments and general developments in the turbine field are making possible more efficient utilization of gas temperatures, and our materials programs and cooling programs are being directed toward handling these temperatures.

Q. With what materials are you experimenting?

A. (Silverstein) Ceramels—combinations of ceramic materials with metals.

Afterburners Improved

Q. Are you making any progress toward cutting down the high fuel consumption rate of afterburners?

A. (Silverstein) Yes, we're making great strides toward that end through improvements in afterburner combustion efficiency.

Q. What is the specific fuel consumption of a ramjet engine?

A. (Silverstein) I can't discuss it in specifics, but the ramjet is more economical than an automobile engine when flying at high supersonic speeds.

Q. A long-range ramjet-powered missile would necessarily be very large, would it not?

A. (Silverstein) Yes, we anticipate that a long-range ramjet missile will be quite a large airplane because of the volume required for fuel storage.

Q. Who decides along what lines of research you will work?

A. (Sharp) The NACA is assisted by five major and 22 subordinate committees, composed of specialists from industry, the military services and universities. These groups meet with the laboratory staffs and advise the NACA on the nation's research needs. Research lines are also originated by our own staff that are by-products and extensions of discoveries made in the course of our work.

Q. Are you concerned only with long-range research?

A. (Silverstein) No. The research at Lewis may be divided into three main categories: long-range programs which will bear fruit in future years, shorter-range programs, the results of which will be applied to production airplanes within the next few years, and immediate research aimed at the urgent problems.

Q. What is the average age of your scientific personnel?

A. (Sharp) It varies from month to month, but at the moment it is slightly over 28 years. And that includes a number of people who have been with NACA 20 or 25 years.

Q. Does this create an employment problem? Are the draft and reserve recall programs taking away your scientific help?

A. (Sharp) Yes, we do have a serious problem here. It would be much more serious, however, if it were not for the fact that in most instances we have been able to present convincing evidence as to the man's worth to his country right at his work in the laboratory and obtain permission for him to continue. However, should either the draft or recall programs be stepped up, the number of really important men we would lose would increase greatly. You see, today's research has to be handled by young men; they're the only ones with the advanced training required for work on our problems.

Q. I noticed a woman scientist during the inspection tour. Do you have many such?

A. (Sharp) Several, but nowhere near as many as we would like. Women with advanced scientific training have proved themselves just as competent in attacking difficult problems as have our male scientists. We have several husband-wife teams here, with both members of the family holding Ph. D. degrees.

Q. In the course of your research, have you been able to eliminate any of the various engine types—pulse-jet, rockets, etc.—as impractical?

A. (Silverstein) No. None has been eliminated. Each has its own field of application.

Jet Helicopters

Q. The Air Coordinating Committee has requested that NACA investigate the helicopter field. What forms of propulsion do you think show most promise for helicopters of the future?

A. (Silverstein) The application of turbine engines and ramjets offers the most promise. Jets located at rotor blade tips help eliminate the unbalanced torque of shaft-driven helicopter rotors.

Q. I noticed that in one of the airplane models used in your demonstrations the engines were located at the wing tips. Is this a design trend?

A. (Silverstein) That is one configuration open for future design layouts. Multiple engine installations may be required to provide the high thrusts needed for supersonic flight and the extremely thin wings of supersonic aircraft will make submerged wing installations difficult.

Q. Will there be a need for reversed thrust in turbojet engines?

A. (Silverstein) The problem of slowing down and making rapid descents with high speed turbojet engines is a serious one. It might be solved by a combination of decelerating devices, such as aerodynamic flaps, and reversed thrust from the engine.

Air Bases: $1 Billion Market for Suppliers

Military spending will jump even further as Air Force expands to 140 wings.

By JAMES J. HAGGERTY, JR.

THE Air Force and Navy will spend more than $1,000,000,000 during the current fiscal year on various types of airport equipment and associated items, according to best estimates.

Authorization for the expenditures is contained in the recently passed public works bill, under which the combined air services will get a total of $2,658,000,000 for expansion of air facilities—$2,301,000,000 for the Air Force and $357,000,000 for the Navy.

But even this huge market for equipment suppliers is due for a big jump. The $2.3 billion voted the Air Force will not even finance the construction and equipment procurement requirements for the authorized 95 wings. The Air Force has stated that it will have to come back for another $1,000,000,000 later in order to provide adequate facilities for the 95 wings.

The money authorized will permit the Air Force to expand to 309 air installations by next June 30; this compares with the current total of 232 bases, but falls far short of the World War II peak of 1,933 bases.

However, considerably more than the 309 bases will be required to contain the approved 95 wings. On top of that, the Joint Chiefs of Staff have agreed that the Air Force should be expanded to about 140 wings, and there is every indication that a sympathetic Congress will go along with that program. So it is almost certain that the Air Force facilities expansion program will be increased well beyond its present scope and consequently the market for equipment suppliers will grow beyond the $1,000,000,000 or more to be spent this year.

More Bases for Navy

Some expansion of Naval air strength is also anticipated and the Navy, too, will probably need another large appropriation next year for facilities expansion, further boosting the equipment market.

There is no concrete figure available as to the exact amount which will go for equipment in the 1952 bill, but reliable Air Force and Navy sources estimate that it will be about 40% of the total—thus, something over $1,000,000,000. Logically, all of the equipment will not be of a type supplied by aviation equipment manufacturers, but the major portion of the money will be spent for such equipment or closely related items.

The remainder of the $2.6 billion appropriation will be spent for construction of runways, buildings and hangars, housing, land acquisition, taxiways and aprons, hazard removal, etc.

Sample items of aviation and allied equipment which will be purchased include: communications equipment of all types, Ground Controlled Approach and Instrument Landing System units and other navigational aids, overhaul shop tools, runway lighting and other lighting equipment (beacons, warning lights, etc.), ground handling equipment, ground refueling equipment, fuel storage equipment, control tower equipment and hundreds of other items.

Dollar Percentages

The Navy provided the following table which gives an indication of the dollar percentages involved in the various items in the facilities expansion program:

Airfield pavement and associated facilities	28.6%
Personnel	14.6
Operational	18.3
Supply	8.8
Overhaul	9.5
Utilities, roads and service	6.9
Research and development	4.9
Public works	4.2
Miscellaneous	1.7
Fuel storage and distribution	2.2
Administration buildings	.3

The Air Force offers this breakdown of its Zone of the Interior program, in dollar value to be expended for facilities in the various categories:

	(in thousands)
Operational support	$1,200,816
Training	439,056
Depot and logistical	267,121
Communication and navigation	5,830
Research, development and testing	123,816
Classified	2,479
Emergency construction	237,586
	$2,096,704

The Air Force will build six new bases in the continental U. S. and an undisclosed number overseas. In addition, the Air Force will undertake expansion projects ranging in cost from as little as $50,000 to as much as $75,000,000 at more than 200 other bases.

Here is the dollar value breakdown of the USAF expansion program:

Department Facilities

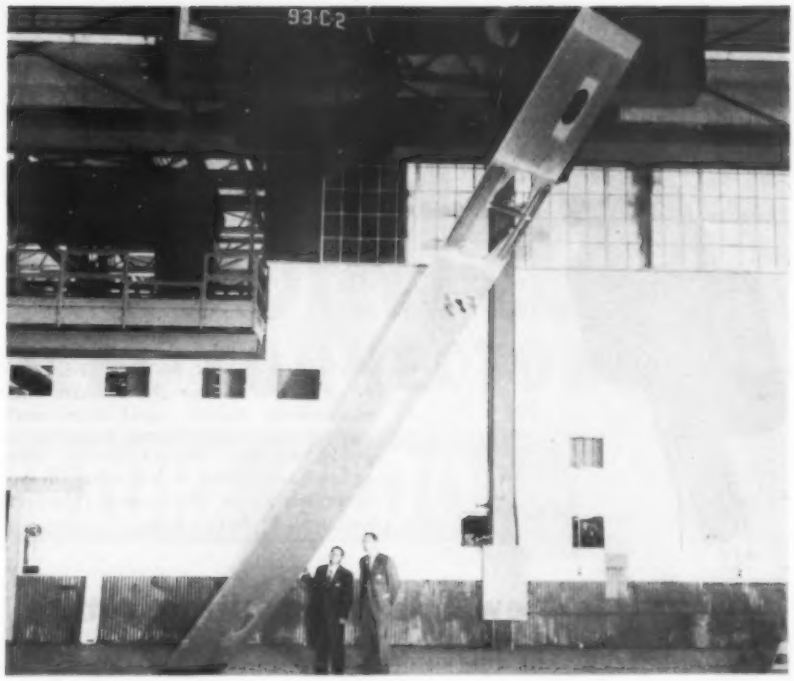
(In thousands of dollars)

Alexandria Municipal Airport, Alexandria, La.	6,548
Altus Air Force Base, Altus, Okla.	17,842
Andrews Air Force Base, Camp Springs, Md.	17,541
Ardmore Airfield, Ardmore, Okla.	14,188
Barksdale Air Force Base, Shreveport, La.	18,331
Bergstrom Air Force Base, Austin, Tex.	16,465
Briggs Air Force Base, El Paso, Tex.	7,883
Burlington Airport, Burlington, Vt.	1,069
Camp Beale, Marysville, Calif.	39,314
Camp Wolters, Mineral Wells, Tex.	14,807
Campbell Air Force Base, Hopkinsville, Ky.	3,026
Carswell Air Force Base, Fort Worth, Tex.	22,297
Castle Air Force Base, Merced, Calif.	9,979
Charleston Airfield, Charleston, S. C.	28,444
Davis-Monthan Air Force Base, Tucson, Ariz.	19,139
Dover Air Force Base, Dover, Del.	26,229
Duluth municipal airport, Duluth, Minn.	2,177
Ent Air Force Base, Colorado Springs, Colo.	2,300
Fairchild Air Force Base, Spokane, Wash.	23,023
Forbes Air Force Base, Topeka, Kans.	20,341
Geiger Air Force Base, Spokane, Wash.	896
George Air Force Base, Victorville, Calif.	4,099
Grandview Airport, Kansas City, Mo.	19,019
Grav Air Force Base, Killeen, Tex.	2,463
Greater Pittsburgh Airport, Coraopolis, Pa.	2,556
Great Falls Air Force Base, Great Falls, Mont.	10,151
Greenville Air Force Base, Greenville, S. C.	15,031
Hamilton Air Force Base, San Raefel, Calif.	3,429
Hammer Air Force Base, Fresno, Calif.	22,303
Hanscom Airport, Bedford, Mass.	3,770
Hensley Air Force Base, Dallas, Tex.	3,022
Hunter Air Force Base, Savannah, Ga.	24,451
Kinross Air Force Base, Sault Ste. Marie, Mich.	6,166
Lake Charles Air Force Base, Lake Charles, La.	12,817
Langley Air Force Base, Hampton, Va.	19,282
Larson Air Force Base, Moses Lake, Wash.	1,760
Lawson Air Force Base, Fort Benning, Ga.	9,058
Limestone Air Force Base, Caribou, Maine	19,181
Lincoln Airfield, Lincoln, Nebr.	29,451
Lockbourne Air Force Base, Columbus, Ohio	18,094
MacDill Air Force Base, Tampa, Fla.	9,914
March Air Force Base, Riverside, Calif.	15,390
McChord Air Force Base, Tacoma, Wash.	8,797
McGhee-Tyson Airport, Knoxville, Tenn.	2,797
McGuire Air Force Base, Wrightstown, N. J.	50,000
Mitchel Air Force Base, Hempstead, N. Y.	1,191
Morrison Air Force Base, West Palm Beach, Fla.	8,320
Mount Home Air Force Base, Mount Home, Idaho	21,109
Newcastle County Airport, Wilmington, Del.	1,631

Niagara Falls Airport, Niagara Falls, N. Y.	2,451
Offutt Air Force Base, Omaha, Nebr.	19,063
O'Hare International Airport, Chicago, Ill.	1,982
Orlando Air Force Base, Orlando, Fla.	699
Oscoda Air Force Base, Oscoda, Mich.	1,633
Otis Air Force Base, Falmouth, Mass.	3,591
Oxnard Air Force Base, Oxnard, Calif.	3,987
Paine Field, Everett, Wash.	1,522
Pope Air Force Base, Fort Bragg, N. C.	20,335
Portland Municipal Airport, Portland, Oreg.	1,793
Portsmouth municipal airport, Portsmouth, N. H.	46,558
Presque Isle Air Force Base, Presque Isle, Maine	1,507
Rapid City Air Force Base, Rapid City, S. Dak.	17,532
Sedalia auxiliary field, Knobnoster, Mo.	22,462
Selfridge Air Force Base, Mount Clemens, Mich.	3,193
Sewart Air Force Base, Smyrna, Tenn.	15,194
Shaw Air Force Base, Sumter, S. C.	18,922
Smoky Hill Air Force Base, Salina, Kans.	24,365
Stead Field, Reno, Nev.	2,109
Suffolk County Airport, West Hampton Beach, N. Y.	1,982
Travis Air Force Base, Fairfield, Calif.	18,801
Truax Air Force Base, Madison, Wis.	4,035
Turner Air Force Base, Albany, Ga.	7,308
Walker Air Force Base, Roswell, N. Mex.	13,111
Westover Air Force Base, Chicopee, Mass.	11,427
Weld-Chamberlain Field, Minneapolis, Minn.	3,969
Youngstown municipal airport, Youngstown, Ohio	6,206
ZI classified provision of necessary facilities to support Army units	15,752
Various locations United States	23,000
Raleigh-Durham	33,315

Training Facilities

Amarillo Airfield, Amarillo, Tex.	13,814
Big Spring Municipal Airport, Big Spring, Tex.	3,133
Bryan Air Force Base, Bryan, Tex.	5,341
Camp Shoemaker (naval recruiting station), Shoemaker, Calif.	58,422
Chanute Air Force Base, Rantoul, Ill.	11,759
Clovis Air Force Base, Clovis, N. Mex.	4,670
James Connally Air Force Base, Waco, Tex.	12,778
Craig Air Force Base, Selma, Ala.	1,822
Ellington Air Force Base, Houston, Tex.	706
Foster Field, Victoria, Tex.	11,082.8
Francis W. Warren Air Force Base, Cheyenne, Wyo.	7,042
Goodfellow Air Force Base, San Angelo, Tex.	1,583
Harlingen Air Force Base, Harlingen, Tex.	15,462
Keesler Air Force Base, Biloxi, Miss.	42,098
Kirtland Air Force Base, San Antonio, Tex.	63,753
Laredo municipal airport, Laredo, Tex.	8,577
Laughlin Field, Del Rio, Tex.	13,701
Lowry Air Force Base, Denver, Colo.	25,520
Luke Air Force Base, Phoenix, Ariz.	267
Mather Air Force Base, Sacramento, Calif.	4,024



LARGEST SINGLE PIECE of aircraft wing ever made is this 323-pound 32 x 4-foot panel milled from a slab of aluminum alloy, an integrally stiffened wing section for the Lockheed Super Constellation. Costing about $7,000, the panel is one of six required for each wing of the L-1049. Mass production of these panels, to replace some 1500 riveted parts, will soon be under way on Lockheed's $400,000 Giddings and Lewis skin mill. Panels fit between main spars on the underside of the wing between the engines.

Moody Air Force Base, Valdosta, Ga.	1,951
Nellis Air Force Base, Las Vegas, Nev.	1,870
Perrin Air Force Base, Sherman, Tex.	2,187
Pinecastle Air Force Base, Orlando, Fla.	24,759
Randolph Air Force Base, San Antonio, Tex.	6,450
Reese Air Force Base, Lubbock, Tex.	967
Sampson Air Force Base, Sampson, N. Y.	9,095
San Marcos Air Force Base, San Marcos, Tex.	157
Scott Air Force Base, Belleville, Ill.	14,071
Sheppard Air Force Base, Wichita Falls, Tex.	21,921
Tyndall Air Force Base, Panama City, Fla.	928
Vance Air Force Base, Enid, Okla.	348
Wichita Municipal Airport, Wichita, Kans.	37,145
Williams Air Force Base, Chandler, Ariz.	1,252
Various locations within United States	9,250
Gulfport auxiliary to Keesler, Gulfport, Miss.	1,781

Depots and Logistical

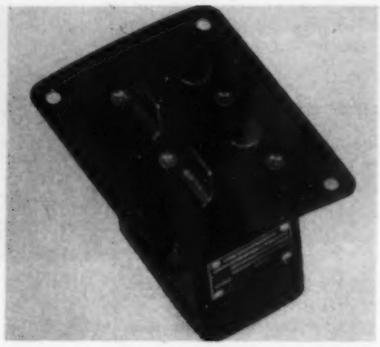
Brookley Air Force Base, Mobile, Ala.	11,380
Dayton 862d Air Force Base, Dayton, Ohio	13,006
Griffiss Air Force Base, Rome, N. Y.	8,693
Hill Air Force Base, Ogden, Utah	2,935
Kelly Air Force Base, San Antonio, Tex.	35,444
Lynn Haven Air Force Base, Lynn Haven, Fla.	59
Mallory (830th) Air Force special depot, Memphis, Tenn.	84
Maywood (822d) Air Force special depot, Maywood, Calif.	107
McClellan Air Force Base, McClellan, Calif.	23,835
Norton Air Force Base, San Bernardino, Calif.	6,575
Olmsted Air Force Base, Middletown, Pa.	74,093
Robins Air Force Base, Macon, Ga.	20,683
Shelby (831st) Air Force special depot, Shelby, Ohio	13,237
Tinker Air Force Base, Oklahoma City, Okla.	8,202
Topeka (832d) Air Force special depot, Topeka, Kans.	352
Wright-Patterson AFB, Dayton, Ohio	35,436
Various locations within United States	13,000

Communications and Navigational Aids Facilities

Various zone of interior	4,080
Various locations	1,750

Research, Development, and Test Facilities

Bedford Research Center, Bedford, Mass.	17,970
Climatic Projectile Research Laboratory, Mount Washington, N. H.	223
Cornell Aeronautic Laboratory, Buffalo, N. Y.	1,500
Edwards Air Force Base, Muroc, Calif.	31,441
Eglin Air Force Base, Valparaiso, Fla.	45,549
Holloman Air Force Base, Alamogordo, N. Mex.	6,147
Kirtland Air Force Base, Albuquerque, N. Mex.	8,540
Patrick Air Force Base, Cocoa, Fla.	0
Headquarters, Research and Development command, site to be selected	5,446
Various locations within United States	7,000



SMALL ECCENTRIC MOTOR under handle of control column (left) shakes stick on receiving electric signal from small wing tab instrument (above), which detects approaching stalls. Margin between warning and actual stall is controlled by adjusting tension of tabs so they close electric circuit at desired time.

Navy Tries New Stall Warning System

Safe Flight instrument has also been adopted by other military and civil manufacturers.

THE Navy is experimenting with a new pre-stall warning system developed by Safe Flight Instrument Corp. as a means of reducing accidents to jet fighters and bombers as they land on aircraft carriers.

The instrument causes a gentle buffeting in the stick or control column as the plane approaches stalling speed. The buffeting becomes more violent as air speed continues to drop off. System undergoing Navy tests contains a special addition to give stall information not only to the pilot but also to the Landing Signal Officer.

Stall warning instruments are needed on jet carrier aircraft because, unlike propeller planes, jets do not possess sufficient quick power at sea level to enable a pilot to pull up if he drops too low in the landing pattern. Approach speeds must be near the stall point, but pilots must not be caught in a low and slow situation from which there is no return.

Familiar Feeling

The buffeting caused by the instrument is a more pronounced duplication of the stick shaking characteristic of some planes as a stall begins. Thus, it is a feeling every pilot is schooled to recognize immediately. Difference between the instrument's warning and the natural wobbly feeling of the stick in a stalling plane is that the Safe Flight system provides positive buffeting at a predetermined airspeed above the stall point, where the pilot, without the pre-stall warning, would not be able to feel anything unusual in the plane's performance.

The device is expected to serve as a steady stall warning and approximate air speed indicator for Navy pilots flying in a carrier's traffic landing pattern. By use of the instrument, the pilot receives constant information about his plane's speed through his hand as it holds the stick. This enables him to fly the plane at slow speeds and still keep his head out of the cockpit.

Two systems for providing pre-stall information to Landing Signal Officers as well as the pilot are being investigated by the Navy. They consist of:

- **Lights mounted on the leading edge** of the plane's wing and actuated by the same sensing instrument which controls the stick shaker. Color of the lights shows the LSO how close to stalling speed the approaching plane is flying.
- **Series of lights mounted on a panel** near the LSO. These lights are also actuated by the airplane's sensing device. Signals operating the LSO's panel lights are automatically radioed from the plane.

Heart of the pre-stall instrument is a small metal tab called a flow detector vane located on the leading edge of the wing. The vane is usually installed below the point on the wing's leading edge where airflow divides and passes above and below the wing. This stagnation point moves down the leading edge in response to varying conditions of speed, acceleration, and loading.

As these conditions bring the plane near a stall and the stagnation point slides down the leading edge, airflow past the metal vane reverses, pushing the tab upward and closing an electric circuit. Stick shaker mechanism, located just under the handle of the control stick (see cut), is actuated by current from the detector vane.

Changes in the airplane's wing loading, whether caused by changes in gross weight or acceleration, of course influence the lower limit of the stagnation point, which is a characteristic of the airfoil section. The stagnation point shifts in the same proportion as the lift conditions of the wing change. Thus, in giving warning of shift in stagnation point, the Safe Flight instrument is actually warning of the wing's decreased lift coefficient.

Adjustable Margin

Basic means of adjusting the warning margin is by changing location of the detector unit on the chord of the wing, placing the unit in a position to respond to the position of the stagnation point in pre-stall situations.

Making the instrument more precise is a third addition to the two basic components of the system. This is a vernier adjustment dial which permits the operator to turn a pointer on the instrument's face to the number of knots or miles per hour of stall-warning margin he desires. The vernier, calibrated down to tenths of knots, adjusts tension on the wing detector vane, causing it to close the circuit at a predetermined velocity below stalling.

The stall warning system has been used by pilots to bracket take-offs and landings of aircraft operating at high gross weights. The pilot can take advantage of the complete lift of the wings by pulling the plane into an altitude at which he receives mild buffeting signals from the system. He then rides the mild buffeting up or down, depending upon whether he is taking off or landing. He need undertake corrective measures only as the buffeting increases, telling him that a full stall is approaching.

Aircraft manufacturers who have adopted Safe Flight stall warning systems as standard equipment include Grumman on the F9F, AF2W, AF2S, and JR3F; McDonnell Aircraft on the F2H; Chance Vought on the F7U-I; Northrop on the F-78A, YRB-49A Flying Wing and the C-125; Douglas on the Super DC-3, AD3W and F3D series.

Safe Flight states that 85% of the personal airplane manufacturers have adopted the system as standard equipment. These manufacturers include Cessna, TEMCO, Luscombe Model T-8F, Aeronca and Beech Aircraft Model 35. Piper has adopted it as optional equipment on its Pacer.

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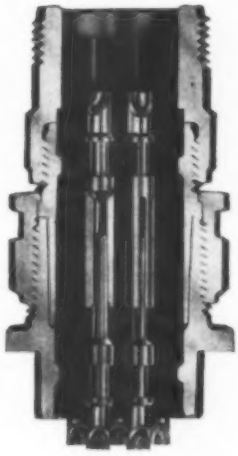

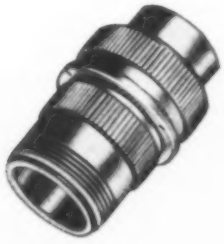

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Deadline for Profit Statements Extended

Aircraft manufacturers won't know until late next year whether their 1951 profits on government business are to be considered "excessive" and whether they'll have to pay back any money to the U. S.

The newly formed Renegotiation Board has extended the deadline, ruling that firms doing more than $250,000 worth of government business annually now have until next Mar. 1 to file financial statements if their fiscal years end before Nov. 30, 1951.

Under terms of the Renegotiation Act, manufacturers were to file statements within three months of the end of their fiscal years. This meant that firms whose years ended June 30 had to file by Oct. 1.

Work on Policy

However, it was Oct. 1 before the Senate approved the members of the board, and an extension was granted to give them time to work out a policy before tackling the financial statements.

Board members will decide whether firms' profits were too high, and if so, will bill them for the difference. Manufacturers can appeal the rulings to the U. S. Tax Court.

Unofficial Defense Dept. policy on contracts has been that about a 2% profit constitutes a fair return. The Board is expected to use this formula as a yardstick, giving a little more profit to small firms and possibly cutting below it in dealing with companies having huge backlogs.

Low Altitude Stall Cause of MCA Accident

CAB has reported that probable cause of a Mid-Continent Airlines DC-3 accident Mar. 2, 1951, was "a stall during a left turn too close to the ground to effect recovery."

In the accident which occurred during a landing approach to Sioux City Airport, the two pilots and 14 passengers were killed. Nine remaining passengers were injured, and the aircraft was completely destroyed. Captain of the plane was James A. Graham, whose total flight time was 8,585 hours, of which 6,971 were in DC-3 aircraft.

Reduced visibility caused by blowing snow was confined to within ten feet of the ground, and the Board found that this was not a factor in the accident. The flight to Sioux City from Omaha was flown in marginal weather, suggesting that light ice formation may have caused the airplane to stall at a speed slightly higher than normal.

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These men have realized ambitions that they've carried with them since they began to build engineering careers. They're Boeing men. And that sets them a little apart. For Boeing is a renowned name in aviation. It stands for bold pioneering in aeronautical research and design . . . for leadership in the building of advanced commercial and military airplanes . . . and for trail blazing in the development of guided missiles, jet propulsion and other fields.

Today, there are many grand career opportunities at Boeing for high-caliber men who can measure up. Needed in Seattle are experienced and junior aeronautical, mechanical, electrical, electronics, civil, acoustical and weights engineers for design and research; servo-mechanism designers and analysts; and physicists and mathematicians with advanced degrees.

It's important, long-range work. The world's hottest jet bombers . . . the fascinating new field of guided missiles . . . the revolutionary new Boeing gas turbine engine—these are among the challenging assignments awaiting you. Here are outstanding research facilities and the men who have built Boeing to world eminence.

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4 Moving and travel expense allowance is provided.

Or if you prefer the Midwest, *there are similar openings available at the Boeing Wichita, Kansas, Plant. Inquiries indicating a preference for Wichita assignment will be referred to the Wichita Division.*

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BOEING

Between the Lines

Letter of the Law - and Then Some

By James J. Haggerty, Jr.

WHEREVER you go in aircraft industry circles these days, one topic is bound to creep into the conversation, and that is the new "no gratuity" provision, which was tossed into the 1952 defense appropriations bill in the form of an amendment.

Briefly, and with all the governmentalese edited out, the amendment forbids any manufacturer to attempt to bribe military procurement officials with gifts or entertainment with a view toward securing a contract thereby or obtaining preferential treatment in the administration of a contract. Any contractor caught in the act may have his contract or contracts cancelled immediately and may find himself liable to a breach of contract suit as well. In addition, he may be fined not less than three nor more than ten times the value of the gratuity he offered.

Manufacturers doing legitimate business have little complaint with the amendment itself although they are inclined to view it as legislation for the masses to punish the few. Although there are no doubt a few fast deals being pulled by a very small minority of shady-dealing manufacturers, the vast majority of contractors are honest businessmen merely trying to sell a legitimate product and make a legitimate dollar in the process.

But what is annoying the industry is the Air Force's interpretation of the amendment. As is almost always the case with the boys in blue, they couldn't be content to merely enforce the letter of the law; they had to bend over backwards and go far beyond the intent of Congress. Air Materiel Command issued a sweeping directive threatening fire, brimstone and eternal damnation to any AMC officer who accepts *any* gratuity of *any* sort from *any* contractor.

So all reason has gone out the window at AMC's headquarters, Wright-Patterson Air Force Base in Dayton. They no longer dare to accept even a free drink or a free lunch for fear of a Congressional investigation and the gag around the aircraft industry is that they will accept a cigarette only after a careful look around to see who is watching. They regard all civilians with brief cases with suspicion, for fear he might be carrying a deadly gratuity in the brief case.

Word of Honor

As a matter of fact (and this we found hard to believe until we had checked it carefully), manufacturer representatives entering Wright-Patterson now have to sign a pledge that they will not try to bribe anyone while on the base.

If you care to carry this to the extreme (and AMC gives every indication of wanting to do so) you can imagine the sort of things which might occur within a few months. For instance:

Scene in the office of Maj. Gen. Waldo Schmidlapp, Chief of Gratuity Investigation, AMC:

Principals: Gen. Schmidlapp and Lt. Waldemar McWhortle, assistant deputy chief of thermocouple procurement.

Schmidlapp: Lieutenant, some very serious charges have been lodged against you. Do you deny that on the afternoon of October 17 you accepted a cigarette from one John Jones of the Ajax Thermocouple Co.?

McWhortle: I'm afraid I did, sir.

Schmidlapp: And a stick of chewing gum?

McWhortle: Yes, sir. I lost my head.

Schmidlapp: And on the same day, did you accept a ride from Area A to Area B in an automobile driven by a first cousin to Mr. Jones' secretary?

McWhortle: I have no defense, sir.

Schmidlapp: Mr. Jones will be barred from the base, of course. But with you, lieutenant, it's going to go harder because of The Directive. You are aware of the consequences?

McWhortle: (Nodding grimly) Yes, sir.

(Schmidlapp opens desk drawer and takes out sharp hara-kiri knife which he passes to McWhortle. McWhortle accepts it gingerly, then straightens up, head held high and walks slowly to hara-kiri altar in adjoining room. End.)

Other Possibilities

The Directive offers other possibilities, too, such as business opportunities. It may open up a whole new field-gratuity espionage. Suppose Company A has a contract that Company B wanted badly. If Company B can get the goods on Company A, the latter's contract will, of course, be cancelled and Company B can submit a new bid. We can envision something like this:

Scene in the office of the Cato V. Claggett, Director of Gratuity Espionage for Eagle Aircraft Corp:

Principals: Claggett and Phineas McNish, field gratuity espionage representative.

Claggett: How did you make out this trip, McNish?

McNish: On November 3 at 5:20 p.m. in the Kitty-hawk Lounge I observed Maj. Boris Zoris having cocktails with a young lady who works as a file clerk in the Dayton office of Turbojet Corp.

Claggett: (Thoughtfully) Turbojet, eh? Might be something there, McNish. The boss has been thinking of starting an engine division.

McNish: (Wistfully) The major paid for the drinks, though.

Claggett: Just a cover-up, McNish. It won't stand up in court. What else?

McNish: Well, here's my prize of the week, boss. On November 5, Capt. Humphrey Higglewit and Foster Finch of Midwest Aircraft Corp. played a round of golf together– *and Finch paid for both caddies!*

Claggett: (Jumping up and pounding desk excitedly) That's it, McNish! Midwest got that light bomber contract we lost in the competition! (Snapping intercom button) Miss Smith, tell the boss I must see him as soon as possible. And get Gen. Schmidlapp at Wright-Patterson on the phone. (Turning back to McNish) Oh, by the way, McNish. You're fired. Gadsby of Eastern Aircraft's Counter Gratuity Espionage Department has discovered your identity and you're no longer of any use to us.

Industry Personnel

Chance Vought Aircraft has selected **Harry E. Kay** contract administrator, **Thomas F. Seymour** his assistant and **Dale Marks** chief industrial engineer . . . **George A. Page** has been named director of research and engineering for Aeronca Manufacturing Corp.

Douglas Aircraft Co.'s former chief of research and test pilot, **Gene Mays**, has been appointed chief of flight operations at the Tulsa plant . . . **Donald F. Warner** has been chosen assistant to the manager of engineering for General Electric Co.'s Turbine Department.

Monson Manhart

Charles D. Manhart has been named aircraft products section manager of the Bendix Products division of Bendix's South Bend plant . . . **Claude N. Monson**, treasurer of the Garrett Corp., has been appointed manager of the AiResearch Manufacturing Co. of Los Angeles.

Franklin C. Wolfe and **Robert C. Cavanaugh** have been elected directors of Menasco Manufacturing Co. . . . Norden Instruments, Inc. has named **Wayne M. Pierce** manager of operations, **Ernest J. Greenwood** chief engineer and **David M. Richey** production manager . . . **Warren A. Shuping** is the new manager of Fairchild Aircraft Division's quality control department.

Bendix Aviation Corp.'s Utica Division has selected **Alan Kahn** industrial relations director while the Bendix Radio Division has appointed **Henry B. Yarbrough** manager of government sales; **J. Walter Colvin** manager of Air Force sales; **Walter G. Jager** assistant manager of government sales; **James R. Wallace** administrative assistant to the general sales manager; and **F. Donald Fenhager** manager of public relations and advertising.

Simmonds Aerocessories, Inc. has elected **Howard Holmes** vice president and general manager of development and contracts and **M. I. Benton** vice president and general manager of manufacturing operations at the firm's Vergennes, Vt., plants.

ARO, Inc., which will operate the engine test facility at the Arnold Engineering Development Center, Tullahoma, Tenn., has appointed **Gaylord W. Newton** to head the project . . . **E. J. (Bud) Huber**, formerly director of public relations for Piasecki Helicopter Corp., has joined Gyrodyne Co. of America as a vice president handling public and customer relations . . .

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RMI PROVES ITS LEADERSHIP with WORLD RECORD PERFORMANCE!

The highest and fastest single-stage rocket flight—Navy's Martin Viking.

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The first piloted flight through the sonic barrier—Air Forces' Bell X-1.

The three major world records—ALL RMI POWERED! Stay in the lead—work with RMI—the world leader in liquid propellent rocket motors and power generating devices.

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Four great domestic airlines now offer dependable Constellation service to principal U. S. cities! Next time you travel choose one of the *fifteen* world airlines that fly experienced Constellations.

KOREAN BOOMERANG—Like Lockheed's famous Hudson Bomber ("Old Boomerang") of WW II, the F-80 *Shooting Star* has proved rugged in combat. Built to take terrific battle damage yet return to base, the F-80 did exactly that in Korea . . . another "Boomerang."

SCIENCE OF DEPENDABILITY—Lockheed's new Electronics Building will house an advanced "Weather Laboratory," where every effect of weather can be studied first-hand...increasing the *experience* behind Lockheed dependability.

Fly Constellations Via:

IN THE U. S.—Capital Airlines, Chicago & Southern Air Lines, Eastern Air Lines and Trans World Airlines.

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Lockheed

AIRCRAFT CORP., BURBANK, CALIF.

Look to Lockheed for Leadership

Lockheed

BEGINS WORK ON GIANT JET BOMBER

Production of an undisclosed number of giant B-47 jet bombers has begun at Lockheed's Marietta, Georgia, factory.

As the world's leading producer of jet aircraft and modern high-speed transports, Lockheed is especially qualified to build the Boeing-designed B-47's for the Air Force. Production floor space at Marietta, plus Lockheed's California factories, makes Lockheed as large today as the entire U.S. air-frame industry in 1940.

What's going on at Lockheed? Lockheed has developed a high-speed camera with a speed range of from 1,000 to 3,000 frames a second. At 3,000 per second, a 100-foot roll of 16-mm film goes through the camera in 1¼ seconds. Purpose of the speed: to check results when fast-dropping die hits a blank piece of metal. Objective: development of stronger, new-type alloys for greater, faster aircraft ... Another current research project creates arctic flying conditions 20,000 feet above the California desert. On an actual F-94 All Weather Jet Fighter, a spray bar shoots a fine, foggy mist on the nose and wing, building up layers of ice. Plane's de-icing equipment is thus tested in actual flight.

Past and future at Lockheed... One of Lockheed's earlier transports, a Model 10 Electra, is approaching its 25,000th hour of flying time, in continuous service since 1937 for South Coast Airways, Pty., Ltd., of New South Wales (Australia)... New Lockheed Super Constellations, in service by year's end, will be the largest, fastest, rangiest commercial transports in service. So well have earlier Constellations proved themselves around the world that more than 100 Super Constellations were ordered before the first production model flew... The new Lockheed-developed thin wing for the advanced F-94C—so thin it looks almost fragile—is strong enough to support two fully-loaded Super Constellations (150 tons dead weight)—one at each wing tip. This new plane, America's continental defender because of its electronic superiority, contains enough installed electrical power to supply a small community.

Production Spotlight

FJ-2 Coming: North American Aviation's tooling work for production of the Navy FJ-2 carrier-based jet fighter is progressing at the company's Columbus, O. plant and actual production is expected to get under way shortly after the first of the year. Meanwhile, the prototype model of the plane is nearing completion at the company's Los Angeles plant and should be ready for flight before the first of the year. The FJ-2 is the Navy version of the Air Force's F-86 Sabre, generally similar to the F-86E.

Another Electronics Build-up: **Thompson Products, Inc. has acquired Antenna Research Laboratory of Columbus, O. as another step in its planned build-up of an electronics division. Thompson plans to set up facilities in Columbus for large-scale production of antennas, while the laboratory and a leased machine shop continue research and development work.**

Ford and Canadair T-33 Contract: Ford Motor Co. of Canada Ltd. expects to receive a contract from Canadair, Ltd., to produce wings for Canadair's version of the Lockheed T-33 jet trainer. Deliveries would start about the middle of next year.

$1.5 Million Subcontract: **Aircraftsmen Co., Gardena, Calif., has received a $1,500,000 contract from Firestone Tire and Rubber Co. to build and assemble guided missile parts. Firestone is prime contractor on the Douglas-developed Corporal E missile.**

American Helicopter Expands: American Helicopter Corp. has opened its new helicopter power plant manufacturing and test facility at Falcon Field, Mesa, Ariz. The new center has 40,000 square feet of floor space and 700 acres of adjoining airfield. It will provide additional facilities for the company's Air Force helicopter and pulse-jet power plant projects.

Training Instead of Turnover: **Texas Engineering and Manufacturing Co. has instituted a new program designed to cut down on personnel layoffs. Under the new program, when the requirement for certain types of skills ceases to exist, Temco takes the employes with those skills and teaches them new skills currently in demand. Temco cites as an example its recent transfer of Douglas C-54 overhaul operations from Dallas to Greenville, Tex. Normally, about 200 workers who had been working on overhaul would have been dropped from the payroll. Instead Temco gave them a two-week, eight-hour-daily training course in production work and assigned them to new jobs. The company thinks the two-week training period is less expensive than it would be to advertise for, hire and indoctrinate new employes.**

Ford P&W R-4360 Progress: **Ford Motor Co.'s Aircraft Engine Division, Chicago, Ill., will make its first shipment of engines to the Air Force about next March. Ford is building Pratt & Whitney R-4360 piston engines. Now preparing for volume production, the division has about 4,200 of the 6,200 machine tools required. Employment totals 7,275, against an estimated requirement of 12 to 14,000 when full production is reached. About 700 subcontractors have been lined up for various engine parts.**

Too Much for Hughes: The reason for the deal whereby the Air Force will purchase the new Hughes Aircraft Co. electronics plant at Tucson, Ariz., is rising costs. Where the company had originally thought it could build the 500,000 square-foot plant for $7,000,000, cost estimates have now risen to almost $12,000,000. Hughes was willing to finance the $7,000,000 project, but company officials do not feel that they can afford $12,000,000. The plant purchase still has to be okayed by the Senate and House armed services committees.

Beech Expansion: **Beech Aircraft Corp. has reached an agreement with the city of Liberal, Kans. to take over most of the facilities at Liberal's air base for military plane production.**

J. J. H.

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The entire fleets of DC-6B passenger transports in the Pan American and Panagra services will fly with Sperry instruments. These instruments complement one another, making it possible for the human pilot to uphold his line's reputation for safe, smooth, comfortable, enjoyable on-schedule flights in all weather and conditions of visibility.

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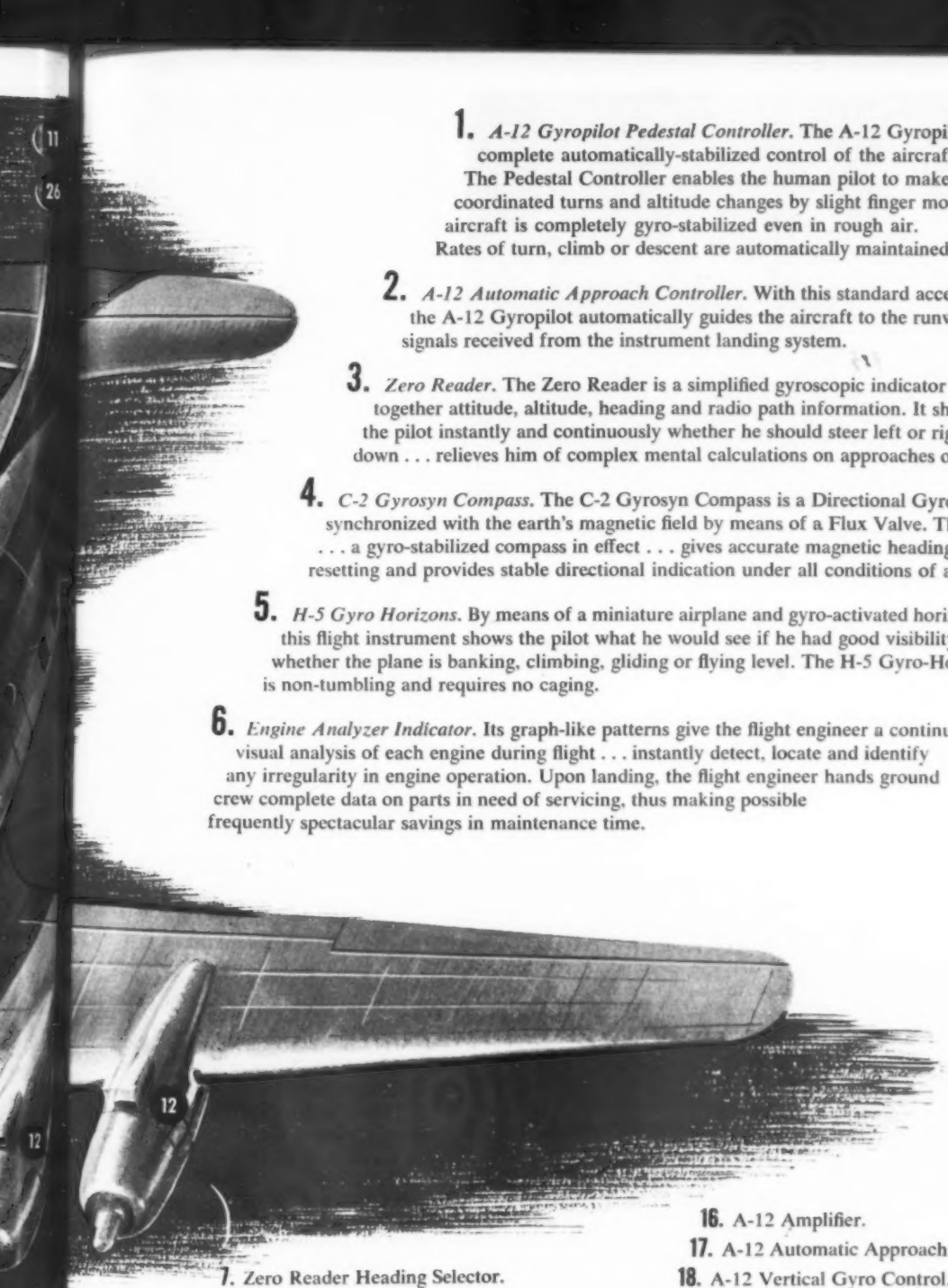

1. *A-12 Gyropilot Pedestal Controller.* The A-12 Gyropilot provides complete automatically-stabilized control of the aircraft through all weather. The Pedestal Controller enables the human pilot to make coordinated turns and altitude changes by slight finger motion while the aircraft is completely gyro-stabilized even in rough air. Rates of turn, climb or descent are automatically maintained.

2. *A-12 Automatic Approach Controller.* With this standard accessory the A-12 Gyropilot automatically guides the aircraft to the runway with signals received from the instrument landing system.

3. *Zero Reader.* The Zero Reader is a simplified gyroscopic indicator which pieces together attitude, altitude, heading and radio path information. It shows the pilot instantly and continuously whether he should steer left or right, or go up or down . . . relieves him of complex mental calculations on approaches or landings.

4. *C-2 Gyrosyn Compass.* The C-2 Gyrosyn Compass is a Directional Gyro synchronized with the earth's magnetic field by means of a Flux Valve. This instrument . . . a gyro-stabilized compass in effect . . . gives accurate magnetic heading, requires no resetting and provides stable directional indication under all conditions of air turbulence.

5. *H-5 Gyro Horizons.* By means of a miniature airplane and gyro-activated horizon bar, this flight instrument shows the pilot what he would see if he had good visibility outside — whether the plane is banking, climbing, gliding or flying level. The H-5 Gyro-Horizon is non-tumbling and requires no caging.

6. *Engine Analyzer Indicator.* Its graph-like patterns give the flight engineer a continuous visual analysis of each engine during flight . . . instantly detect, locate and identify any irregularity in engine operation. Upon landing, the flight engineer hands ground crew complete data on parts in need of servicing, thus making possible frequently spectacular savings in maintenance time.

7. Zero Reader Heading Selector.
8. Zero Reader Selector Switch.
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10. C-2 Gyrosyn Compass Amplifier.
11. C-2 Gyrosyn Compass Flux Valve.
12. Engine Analyzer Synchronizing Generators.
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14. Engine Analyzer Condition Switch.
15. Engine Analyzer Power Supply-Amplifier.
16. A-12 Amplifier.
17. A-12 Automatic Approach Amplifier.
18. A-12 Vertical Gyro Control.
19. A-12 Gyrosyn Compass Control.
20. A-12 Pilot Engaging Control.
21. A-12 Servo Control.
22. A-12 Rudder Servo.
23. A-12 Aileron Servo.
24. A-12 Elevator Servo.
25. A-12 Elevator Trim Tab Servo.
26. A-12 Flux Valve.

LARGEST FOREIGN REPRESENTATION to attend any of the conferences was present this year. Eleven foreign carriers participated. Shown above, left to right, are: J. Philippet and Jean Aguer of Air France, A. B. Holmer, Scandinavian Airline System; R. A. Lydy and R. A. Strahan, president of Champion Spark Plug Company.

Trend to One-Time Use of Spark Plugs

Champion's annual conference points up practices, new ideas in ignition and plug maintenance.

By WILLIAM D. PERREAULT

AT THIS late date in the history of the piston engine, the aviation industry is just beginning to understand the true nature of many of its engine ignition troubles.

A demand for factual data on plugs and related problems was forced by the high-performance postwar aircraft and particularly by high-flying aircraft. Greatest single factor in providing this required information is the annual spark plug and ignition conference, sponsored by Champion Spark Plug Company.

Earlier this month some 150 technicians and engineers from industry and government met in Toledo for this year's conference. The meeting was national and international in scope, military and civil. On hand were representatives from 11 foreign airlines, 23 from the military services, 27 from U. S. airlines, 40 from manufacturing companies, 21 from oil companies, etc. Whatever problems were presented, competent men were there to provide answers.

The conference disclosed:

• **A trend toward one-time usage of spark plugs** with the elimination of plug overhaul. Trend most noticeable among operators of the P&W R-2800 engine and with military operators of the R-4360 engine.

• **Enough experience has been gained with Bendix low-tension ignition systems** to establish that improved performance is provided over that of high-tension systems.

• **Hot concentrated hydrochloric acid is the most effective chemical** for use in removing deposits from spark plugs during overhaul. A combination chemical abrasive cleaning procedure is the most desirable, according to extensive tests conducted by E. I. du Pont de Nemours & Co.

• **Metallic lead is the chief offender among harmful deposits** formed on aircraft spark plugs. A new fuel additive, tested by Shell Oil Company, promises to increase foul-free operation time by some 1100%.

• **Champion Spark plugs are used almost exclusively** in all U. S. transports, but several operators are now conducting service tests on other types, particularly the AC-181. USAF is using the AC-181 in the Douglas C-74, C-124 and Boeing C-97A.

The extent to which Champion has taken over the commercial airline plug business is indicated by the fact that 74 of the 102 airline, airplane and engine combinations reported (see chart) use the R-37S-1 plug exclusively. Eight others use the R-37S-1 with an alternate plug. The RB-19R-2 is the most prominent of the alternate plugs, being in use in 10 combinations.

A trend in spark plug utilization, both over-all and between overhauls, is evident. Average plug life is now 755 hours. Twenty-two operators (airline and engine combinations) of 54 reporting have CAA approval for on-condition plug overhaul. Average approval overhaul time of the remaining operators is 387 hours, and the average actual time at which plugs are pulled by all operators is 225 hours.

Bendix low-tension ignition systems are in use on 18 engine-airplane combinations, with 10 of these on P&W R-2800 engines and 8 on Wright R-3350's. With average hours between actual pulls running 225 hours for all airline-engine combinations, actual time on the R-2800 low-tension systems was 236 hours, as compared with 197 hours for the R-2800 high-tension systems.

Fifty-seven of the engine-airplane combinations are using initial spark plug gaps in the .011 to .014 range, while the remainder use .015, .016 or .018. Fifteen airplane-engine combinations use water injection with R-2800's; six, including the Military Air Transport Services, use it on the R-4360, but none of the Wright R-3350 engines is using water injection, the survey shows.

The economics of spark plug overhaul is dictated to a large degree by the cost of the plug, its service life and post-overhaul performance. These factors have moved the U. S. Air Force to adopt a policy of using new plugs exclusively in the Pratt & Whitney R-4360 engines.

Rejected 15%

Air Force technicians have run tests on 10,000 plugs installed in the Convair B-36 and found as high as 15% rejection of overhauled plugs during initial run-up. Average life of the overhauled plugs was only 35 hours.

Although the issue is not clear-cut today, faulty ignition operation, cured by use of new plugs only, was limiting the operational altitude of the B-36. At Pan American Airways, enough difference of opinion exists that in the Atlantic Division new plugs are used exclusively in the R-4360, while in the Pacific Division new and overhauled plugs are used interchangeably.

Braniff's Pan American Airways, Scandinavian Airlines and Panagra are using new plugs only in the P&W R-2800, while Northwest Airlines is using them in the R-4360, and American Airlines is planning to go to new plugs only in the CB-16 series of R-2800's. Northwest's records show that the off-schedule removal rate dropped from 3.68 per 1,000 hours with old plugs to 1.5 per 1,000 hours with new plugs.

Use of new plugs only on the R-4360 and R-2800 engines does not necessarily

indicate that these plugs are then discarded. Most of the operators, including the military services, overhaul the plugs but return them to service in engines of lower power with less critical performance. KLM Royal Dutch Airlines, on the other hand, makes no attempt at reuse.

Man-Hours Saved

By eliminating plug overhaul, KLM has eliminated the work of four men who were previously handling plug overhaul. Plugs are still removed by KLM at periodic intervals for gap checking. With the Lockheed Constellation, KLM gets a plug life of about 1300 hours, but pulls the plugs for regapping at 650 hours.

With the Douglas DC-6, plug life is 1,000 hours, and regapping at 400 hours; with the Convair 240, plug life is about 750 hours, with regapping handled at 150 hour increments. KLM makes an attempt to keep regapped plugs in the same types of engines from which they have been taken.

Cleaning remains a critical operation. The feeling exists that unremoved lead particles in the close-tolerance portions of plugs break down resistance and permits shorting. Chemical analyses of plug deposits by E. I. du Pont de Nemours & Company show that lead, bromine, silicon, carbon and oxygen are the "largest constituents" of plug deposits.

Under certain conditions, plugs run at very lean conditions; as much as 16% of the deposit on the tip of the ceramic was metallic lead. While 24 different chemicals and combinations of chemical were used in efforts to find a universal cleaning agent none of those tried would remove all deposits. Hydrochloric acid proved the most effective but Champion's R. K. Christie, director of research, felt that this might damage parts of the plug.

Possibly a more satisfactory approach to this problem would be some means of minimizing the effects of lead content in fuel. Shell Oil Company has made some worthwhile steps in this direction with tricresyl phosphate. T. C. P., as the new fuel additive is being called, is added to the fuel and combines with the tetraethyl lead and ethylene dibromide in such a way as to provide better scavenging of the lead.

Tetraethyl lead is added to fuel to improve its anti-knock qualities. Ethylene dibromide is added to react chemically with the lead to form a gaseous compound which passes out the exhaust during the engine cycle. At present most aviation fuel contains about 3 cubic centimeters of TEL. Higher lead content, up to 4.5 cc's, was used during the last war with the result that spark plug fouling and other engine difficulties were aggravated. Too much lead remained in the engine.

Tests by Shell using fuel of lower lead content and varying the amount of normal scavenging agent normally used showed little improvement in the foul-free operation of spark plugs. Using T. C. P. the foul free operation was extended from about five hours (in the test machine) to 62 hours, an 1100% improvement.

The U. S. Navy has ordered 125,000 gallons of the specially modified fuel for full-scale tests in the Grumman F8F at Corpus Christi and for helicopter operation at Quantico and Pensacola. Apparently plug fouling is particularly critical in helicopters where the submerged air cooled engine runs at high temperatures.

To Be Service Tested

The airlines, through the sponsorship of the Air Transport Association, are also programming a service test with Shell's T. C. P. As now visualized, but still not final, Pan American, American Airlines, Trans World Airlines, United and Trans Canada Airlines would run tests with aircraft which could readily be segregated for test purposes.

To minimize the fuel storage problem related with another grade of fuel, the new additive will probably be added during refueling for the test period. Until tests have been conducted to determine possible effects of tricresyl phosphate on fuel tank sealants and other system components, the airline tests will be temporarily delayed.

Importance of T. C. P. is particularly great at this time because of the need for higher lead content to make additional fuel available for the mobilization program. A Munitions Board spokesman told the conference that an increase from three to 4.6 cc's of lead per gallon would make another 25,000-30,000 barrels of aviation fuel available daily.

Attention of the meeting moved from plugs to ignition systems to ignition and engine analyzers, analyzers to fuels, fuels to cleaning compounds and procedures and wound up with high interest in spark plug shipping containers.

Champion is experimenting with a cardboard shipping container which would handle 50 plugs. Six airlines are now service-testing this unit. It would replace the individual shipping tubes which cost about three cents each. The equivalent shipping box would cost about 50c making it possible for Champion to keep plug prices fixed despite general rising costs.

Technical Literature

FORK TRUCKS: Engineering and operating information, drawings and cutaway photographs of Baker type JOM fork trucks are presented in the 6-page specification bulletin number 1328, released by Baker Industrial Truck Division of the Baker Taulang Company, 1250 West 80th St., Cleveland, Ohio.

EXTINGUISHER POSTER: A two-color, 12" x 22" poster designed to show employees correct fire extinguisher to use on rubbish, wood, inflammable liquid, or electrical fires can be obtained from Randolph Laboratories, Inc., 8 East Kinzie St., Chicago, Ill.

VALVES AND CYLINDERS: A new, three-color booklet lists every standard air cylinder available in the industry. It presents working drawings and specifications for each model and size cylinder, both standard and cushioned types, single and double-end rods, internal and external threads. Catalog may be obtained by writing Rivett Lathe and Grinder, Inc., Brighton 35, Boston, Mass.

MICA CAPACITORS: Manufacturers' type number and corresponding JAN unit designation, as well as other such data characteristics, derating, dimensions, and tolerances on Cornell-Dubilier mica capacitors are available in the new 60-page Mica and Faradon Capacitor Catalog No. 420-421. Inquiries should be addressed to Cornell-Dubilier Electric Corp., South Plainfield, N. J.

SEALS: "Steelband" strapping, seals, tensioners, sealers, and accessories are illustrated and described in a six-page folder published by Allegheny Steel Band Co., Box 716, Pittsburgh 30, Pa. "Steelband" products are used for banding all types of packages, bales, boxes, bundles, and pallets.

BUSHING HANDBOOK: A booklet, serving as a catalog for Ace Drill Bushings, at the same time provides a cross-reference to approximately 3023 symbols used by leading bushing manufacturers. Catalog, available from Ace Drill Bushing Co., 5401 Fountain Ave., Los Angeles 29, Calif., compares the many diverse symbols to actual A. S. A. standard sizes and specifications.

FINISH FOR LAMINATES: "Garan Finish RS-49" is the title of a technical data sheet describing results obtained with the RS-49 finish for plastic laminates. It is being circulated by Garan Chemical Corp., 7213 Santa Monica Boulevard, Los Angeles 46, Calif.

SURFACE FLATNESS: An illustrated catalog (Number 20) showing how a beam of light is used as a straight line reference in locating and measuring variations in surface flatness is available from Griswold Manufacturing Co., W. Lancaster Ave., Wayne, Pa.

RIGIDIZED METALS: The use of Rigidized metal in place of ordinary sheet stock in such applications as aircraft stairs, loading ramps and similar uses is described in a six-page folder being distributed by Rigidized Metals Corp., 680 Ohio St., Buffalo 3, New York.

1951 AIRCRAFT SPARK

Prepared by Champion Spark Plug Co. from data submitted by the individual air

Engine Model	Aircraft Model	No. Aircraft	Airline	Type Spark Plug Adopted as Standard	Original Gap Setting	High or Low Tension Ign. System	Water Injection	Avg. Gap Erosion Per 100 Hours	Max. Gap Allowed Before Removal (Overhaul)	Avg. Hours Total Plug Life	Max. CAA Approved Hours Before Removal (Overhaul)
R-1820	DC-3	25	CAP	R37S-1	.013-.016	HIGH	NO	.0040	....	450	260
R-1820	DC-3	12	C&S	R37S-1	.013-.016	HIGH[1]	NO	.0030	.028	612[4]	575
R-1820	DC-3	47	EAL	R37S-1	.011-.014	HIGH	NO	.0045	....	650	300
R-1820	DC-3	20	DAL	R37S-1	.011-.014	HIGH	NO	....	....	....	ON COND.
R-1820	DC-3	..	TWA	R37S-1	.011-.014	HIGH	NO	.0030	....	700[4]	....
R-1820	LODESTAR	11	NAL	RC35S	.013-.016	HIGH[1]	NO	.0030	.025	600	150
R-1830	DC-3	..	TWA	R37S-1	.011-.014	HIGH	NO	.0030	....	700[4]	....
R-1830	DC-3	13	SABENA	RB19R-2	.011-.014	HIGH	NO	....	....	605	....
R-1830	DC-3	8	NEA	R37S-1	.013-.016	HIGH[1]	NO	.0045	....	750	350
R-1830	DC-3C	11	AAA	RB19R-2	.011-.014	HIGH	NO	.0022	....	600	ON COND.
R-1830	DC-3	19	PANAIR DO BRASIL	R37S-1	.011-.014	HIGH[1]	NO	.0035	.030	256[4]	....
R-1830	DC-3	10	SWA	R37S-1	.015-.018	HIGH	NO	....	....	1100	450
R-1830	DC-3	7	FAUCETT	R37S-1	.011-.014	HIGH	NO	....	.016	700	....
R-1830	DC-3	3	CARIBAIR	R37S-1	.....	HIGH	NO	....	....	850	ON COND.
R-1830	DC-3	15	CPA	RB19R-2	.011-.014	HIGH	NO	.0030	.020	600	....
R-1830	DC-3	15	CPA	R37S-1	.013-.016	HIGH	NO	.0030	.020	600	....
R-1830	DC-3C	13	PIO	RB27R	.011-.014	HIGH	NO	.0030	....	750	350
R-1830	DC-3	9	PAL	R37S-1	.....	HIGH	NO	.0020	....	600	300
R-1830	DC-3	13	BAL	RB27R	.011-.014	HIGH	NO	....	....	....	400
R-1830	DC-3	10	WAL	R37S-1	.013-.016	HIGH	NO	.0020	....	900	ON COND.
R-1830	DC-3	27	TCA	R37S-1	.012-.014	HIGH	NO	.0020	....	800	....
				RB19R-2	.012-.014	HIGH	NO	.0030	....	750	....
R-1830	DC-3C	12	FAL	R37S-1	.013-.016	HIGH	NO	.0040	....	700	ON COND.
R-1830	DC-3	13	HAWAIR	R37S-1	.013-.016	HIGH	NO	....	....	730	ON COND.
R-1830	DC-3A	56	UAL	R37S-1	.013-.016	HIGH	NO	....	....	....	ON COND.
R-1830	DC-3	35	AFA	R37S-1	.011-.014	HIGH	NO	....	....	1000	....
				RB19R-2	.011-.014	HIGH	NO	.0020	....	1000	....
R-1830	DC-3C	5	EMPIRE	R37S-1	.016	HIGH	NO	.0037	.028	975	475
R-1830	DC-3A	10	SOUTHERN	R37S-1	.013-.016	HIGH	NO	....	.019	890	300
R-1830	DC-3	12	CAL	RB27R	.011-.014	HIGH	NO	.0010	....	600	....
R-1830	DC-3	..	MATS	R37S-1	.011-.014	HIGH	NO	.0010	.014	....	....
				LS-8B	.011-.014	HIGH	NO	.0010	.014	....	....
R-1830	PBY-5A	5	PANAIR DO BRASIL	R37S-1	.011-.014	HIGH[1]	NO	.0030	....	256[4]	....
R-1830	L-161	30	AFA	R37S-1	.011-.014	HIGH	NO	....	....	1000	....
				RB19R-2	.011-.014	HIGH	NO	.0020	....	1000	....
R-2000	DC-4	4	FAUCETT	R37S-1	.011-.014	HIGH	NO	....	.016	400	....
R-2000	DC-4	3	TACA	RB19R-2	.011-.014	HIGH	NO	.0010	....	1000	....
R-2000	DC-4	26	PAA-LAD	R37S-1	.013-.016	HIGH	NO	.0030	.030	1000	....
R-2000	DC-4	25	CAP-PCA	R37S-1	.013-.016	HIGH	NO	.0040	....	450	260
R-2000	DC-4	12	TAL	R37S-1	.013-.016	HIGH	NO	.0020	....	....	400
R-2000	DC-4	18	PAA-PAD	R37S-1	.013-.016	HIGH	NO	.0024	.030	1000	ON COND.
R-2000	DC-4	2	CPA	RB27-R	.011-.014	HIGH	NO	.0030	.020	600	....
R-2000	DC-4	9	BAL	R37S-1	.013-.016	HIGH	NO	.0045	....	....	400
R-2000	DC-4	5	WAL	R37S-1	.011-.014	HIGH	NO	.0030	....	900	ON COND.
R-2000	DC-4	20	NWA	R37S-1	.013-.016	HIGH[1]	NO	.0030	.030	800	600
R-2000	DC-4	6	NAL	R37S-1	.013-.016	HIGH	NO	.0020	.025	1000[4]	400
R-2000	DC-4	23	UAL	R37S-1	.013-.016	HIGH	NO	....	....	....	ON COND.
R-2000	DC-4	19	NAL	R37S-1	.011-.014	HIGH	NO	.0025	....	650	400
R-2000	DC-4	4	FLY TIGER	R37S-1	.013-.016	HIGH	NO	....	.017	500	280
R-2000	DC-4	8	FLY TIGER FOREIGN	R37S-1	.013-.016	HIGH	NO	....	.017	500	320
R-2000	DC-4	6	DAL	R37S-1	.011-.014	HIGH	NO	....	....	....	ON COND.
R-2000	DC-4	8	SABENA	RS192K	.011-.014	HIGH	NO	....	....	520	....
R-2000	DC-4	29	AFA	R37S-1	.011-.014	HIGH	NO	....	....	1000	....
				RB19R-2	.011-.014	HIGH	NO	.0020	....	1000	....
R-2000	DC-4	14	TWA	R37S-1	.011-.014	HIGH	NO	.0030	....	700[4]	....
R-2000	C-54	..	MATS	R37S-1	.011-.014	HIGH	NO	.0010	.014	....	....
				LS-8B	.011-.014	HIGH	NO	.0010	.014	....	....
C9HE	DC-3S	3	CAP	R37S-1	.013-.016	HIGH	NO	....	....	450	260
R-2800	202	12	TWA	R37S-1	.011-.014	LOW	YES	.0015	....	700[4]	....
R-2800	240	79	AAL	R37S-1	.013-.016	LOW	YES	....	.025	800	ON COND.
R-2800	240	4	MCA	R37S-1	.013-.016	HIGH	YES	....	....	....	ON COND.
R-2800	240	16	PAA-LAD	R37S-1	.013-.016	HIGH[1]	YES	.0040	.030	800	....

(Note: Data for engines and aircraft listed on these pages are continued on pages 38 and 39. See

PLUG DATA CHART

lines for the 7th Spark Plug and Ignition Conference, Oct. 2-4, 1951, Toledo, O.

Scheduled Hours Between Removals (Overhaul)	Actual Hours Between Removals (Overhaul)	Unsched. Plug Removals Per 1000 Eng. Hours	Lead Content in CC/US Gal.	Fuel Octane Rating	Average Number Take-offs per 100 Hrs.	Engine Power During			Engine Speed During		
						Take-off	Climb	Cruise	Take-off	Climb	Cruise
130	125	3.1	3.5	90	133	1100	625	550	2400	2000	1850
300	184	....	3.0	91/98	99.3	1200	625	600	2500	2050	1950
300	230	.623	3.25	91	70	1200	650	575	2500	2000	1900
300	300	....	4.2	91	100	1200	625	550	2500	2000	1900
410	....	....	3.5	100/130	93	1200	625	625	2500	2050	1900
150	140	1.0	3.0	91	250	1200	850	685	2500	2300	2000
410	....	....	3.5	100/130	93	1200	625	625	2700	2050	2050
125	85.5	.95	3.3	100/130	60	1200	670	575	2700	2050	2050
350	340	4.0	2.1	91	170	1200	645	600	2700	2050	2050
160	150	2.0	....	91	230	1200	900	625	2700	2550	2050
275	130	....	4.0	91	58.5	1200	700	550	2700	2050	2050
330	330	.5	4.0	91	250	47" HG	30" HG	21" HG	2700	2050	2050
100	110	2.0	3.0	91/98	90	1100	700	540	2700	2550	1750
500	500	5.0	2.96	91	175	1200	650	625	2750	2050	2050
200	....	....	4.0	91	100	1110	790	600	2700	2100	2050
200	....	....	4.0	91	100	1110	790	600	2700	2100	2050
300	250	4.0	3.0	91	196	1200	650	600	2700	2050	2050
300	285	.162	3.0	91	125	1200	700	600	2700	2350	2050
300	....	4.67	3.0	91	124	1200	700	600	2700	2150	2050
360	240	1.1	4.0	91	60	1200	680	550	2700	2050	2050
250	104.4	2.44	2.36	91/98	85.3	1175	740	550	2700	2325	2050
250	104.4	2.44	2.36	91/98	85.3	1175	740	550	2700	2325	2050
300	255	1.2	3.0	91	214	1050	700	525	2700	2050	2050
300	240	1.6	3.9	91/98	125	1200	750	550	2700	2200	2050
300	....	....	3.0	91/96	111	1200	660	550	2700	2050	2100
250	230	4.0	3&4	100	48	1200	780	600	2700	2300	2100
250	230	4.0	3&4	100	48	1200	780	600	2700	2300	2100
475	440	3.8	4.0	91	240	1075	625	550	2700	2150	2050
285	285	3.0	3.0	91/98	200	1100	657	575	2700	2350	2050
....	156	8.0	3.2	100/130	....	....	....	....	....	....	....
200	200	....	4.6	100/130	20	1200	700	750	2700	2300	2000
200	100	....	4.6	100/130	20	1200	700	750	2700	2300	2000
400	330	....	4.0	91	48.2	1200	700	550	2700	2050	2050
250	230	4.0	3&4	100	46	1200	780	625	2700	2300	2100
250	230	4.0	3&4	100	46	1200	780	625	2700	2300	2100
100	110	2.0	3.0	100/130	80	1210	750	565	2700	2550	1750
300	285	.9	3.06	100	38	1450	900	675	2700	2150	2000
375	300	.8	3.5	100/130	30	1450	900	750	2700	2400	2100
130	125	.8	3.8	100	95	1250	1200	735	2700	2200	1900
350	330	2.5	3.93	100	8	1350	825	625	2700	2250	2000
500	450	1.5	4.0	100/115	25	1450	860	650	2700	2300	1830
200	....	....	4.0	91	16	1450	900	650	2700	2200	1920
200	....	1.75	3.0	100	94	1350	835	650	2700	2300	2050
360	240	1.2	4.0	100	60	1350	830	660	2700	2300	2050
400	320	1.27	3.36	100	91	1450	900	680	2700	2200	2100
300	290	2.0	3.0	100	60	1450	900	650	2700	2350	1800
300	266	.68	3.0	100/130	68	1350	880	655	2700	2250	2050
400	325	1.09	3.25	100/130	55	1450	900	700	2700	2250	2050
280	118.3	9.62	3.0	100/130	19	48" HG	33" HG	28" HG	2700	2300	2050
160	....	....	3.0	100/130	9	48" HG	33" HG	30" HG	2700	2300	2050
300	300	....	3.7	100/130	100	1450	820	675	2700	2300	2100
175	124	1.9	3.3	100/130	15	1450	920	675	2700	2550	2050
250	230	4.0	3&4	100	25	1450	900	675	2700	2250	2050
250	230	4.0	3&4	100	25	1450	900	675	2700	2250	2050
400	....	1.9	3.5	100/130	41	1450	950	680	2700	2300	2000
200	200	....	4.6	100/130	13	1350	850	675	2700	2300	1900
200	100	....	4.6	100/130	13	1350	850	675	2700	2300	1900
130	125	2.08	3.8	100	133	1475	1275	810	2800	2400	2200
310	....	1.1	3.5	100/130	100	2400	1240	1080	2800	2300	2050
400	117	3.28	3.6	100	115	2400	1400	1100	2800	2450	2100
175	....	....	4.0	100/130	100	2400	1400	1000	2800	2300	....
375	300	5.0	3.5	100/130	100	2400	1350	1200	2800	2400	2300

(Pages 40 through 43 for footnotes and information on additional engines and planes.)

From Champion Spark Plug Company's

Engine Model	Aircraft Model	Mixture Control Position			Min. F/A Cruise	Maximum Allowable Head Temp. Climb °C	Minimum Climbing Air Speed M. P. H.	Allowable Head Temp. Cruise °C		Minimum Allowable Head Temp. Descent °C	Constant Carb. Air Temp.	Carburetor Air Temp. if not Constant °C	
		Taxi	Climb	Descent				Max.	Min.			Max.	Min.
R-1820	DC-3	AR	AR	AL	....	233	130	233	93	93	NO	38	16
R-1820	DC-3	AR	AR	AL	.072	232	120	219	....	....	32	....	....
R-1820	DC-3	AR	AR	AL	....	205	....	177	....	....	....	....	....
R-1820	DC-3	...	AR	AL	....	218	110	204	121	121	NO	66	....
R-1820	DC-3	AR	AR	AL	....	232	120	232	....	....	NO	38	....
R-1820	LODESTAR	AR	AR	AL	.067	218	130	218	200	....	NO	40	16
R-1830	DC-3	AR	AR	AL	....	232	120	232	....	....	NO	38	....
R-1830	DC-3	AR	AR	AL	.065	260	98	232	....	....	32	....	....
R-1830	DC-3	AR	AR	AR	AL	230	120	200	....	125	NO	38	5
R-1830	DC-3C	...	AR	....	....	260	120	230	180	....	....	....	....
R-1830	DC-3	AR	AR	AR	.072	260	125	232	....	....	NO	40	....
R-1830	DC-3	AR	AR	AR	....	230	110	230	....	....	NO	50	....
R-1830	DC-3	AR	AL	AL	....	230	120	220	180	170	NO	25	0
R-1830	DC-3	AR	AR	AL	....	260	120	232	120	120	NO	40	—10
R-1830	DC-3	AR	AR	AR	....	260	140	232	135	150	NO	90	....
R-1830	DC-3	AR	AR	AR	....	260	140	232	135	150	NO	90	....
R-1830	DC-3C	AR	AR	AL	AL	262	120	232	190	190	....	....	....
R-1830	DC-3	AR	AR	AL	....	260	....	232	170	170	NO	40	15
R-1830	DC-3	AR	AR	AL/AR	BP	232	....	232	....	....	NO	....	....
R-1830	DC-3	AR	AR	AL	....	260	120	230	120	150	NO	35	15
R-1830	DC-3	AR	AR	AL	....	260	110	232	120	120	15/25	....	....
		AR	AR	AL	....	260	110	232	120	120	15/25	....	....
R-1830	DC-3C	AL	AR	AL	.065	260	120	232	170	170	20	....	....
R-1830	DC-3	AR	AR	AR	....	260	130	232	120	120	NO	40	15
R-1830	DC-3A	AR	AR	AL	.068	232	130	232	120	120	NO	32	....
R-1830	DC-3	AR	AR	AR	....	260	110	230	160	160	NO	50	....
		AR	AR	AR	....	260	110	230	160	160	NO	50	....
R-1830	DC-3C	AR	AR	AR	....	260	120	232	190	177	NO	40	38
R-1830	DC-3A	AR	AR	AL	....	260	120	235	120	120	NO	45	15
R-1830	DC-3	...	...	...	....	....	....	....	....	....	....	....	....
R-1830	DC-3	...	...	...	....	260	110	232	150	150	NO	38	15
		...	...	...	....	260	110	232	150	150	NO	38	15
R-1830	PBY-5A	AR	AR	AL	.072	260	125	232	....	....	NO	40	....
R-1830	L-161	AR	AR	AR	....	260	125	230	160	160	NO	50	....
		AR	AR	AR	....	260	125	230	160	160	NO	50	....
R-2000	DC-4	AR	AR	AR	....	230	140	220	180	170	NO	25	0
R-2000	DC-4	AR	AR	AL	....	235	140	195	150	140	NO	....	11
R-2000	DC-4	AR	AR	AL	.070	200	155	190	....	....	....	40	....
R-2000	DC-4	AR	AR	AL	....	233	148	205	....	122	....	38	....
R-2000	DC-4	AR	AR	AR	.062	230	155	190	150	150	NO	40	15
R-2000	DC-4	AR	AR	AR	....	220	145	220	180	170	NO	....	....
R-2000	DC-4	AR	AR	AR	....	232	155	232	150	150	NO	90	....
R-2000	DC-4	AR	AR	AL/AR	BP	232	....	232	....	....	NO	....	....
R-2000	DC-4	AR	AR	AL	....	235	145	235	150	150	NO	30	10
R-2000	DC-4	AR	AR	AL	.065	232	148	232	....	....	15	....	....
R-2000	DC-4	AR	AR	AL	.057	232	140	232	200	....	NO	40	16
R-2000	DC-4	AR	AR	AL	.068	217	150	217	120	160	NO	40	....
R-2000	DC-4	AR	AR	AL	....	190	....	175	....	....	....	....	....
R-2000	DC-4	AR	AR	AR	....	200	130	180	150	150	NO	....	....
R-2000	DC-4	AR	AR	AR	....	200	130	180	150	150	NO	....	....
R-2000	DC-4	AR	AR	AL	....	260	138	232	121	121	NO	40	15
R-2000	DC-4	AR	AR	AL	.065	260	148	232	....	....	15	38	15
R-2000	DC-4	AR	AR	AR	.066	200	140	180	....	170	NO	40	....
		AR	AR	AR	.066	200	140	180	....	170	NO	40	....
R-2000	DC-4	AR	AR	AL	....	232	150	232	....	....	NO	38	....
R-2000	C-54	...	...	...	....	232	155	232	220	100	NO	32	15
		...	...	...	....	232	155	232	220	100	NO	32	15
C9HE	DC-3S	AR	AR	AL	....	232	140	232	150	150	NO	35	30
R-2800	202	AR	AR	AL	....	260	150	232	....	....	NO	38	....
R-2800	240	AR	AR	AR	.070	232	160	232	200	150	NO	....	....
R-2800	240	AR	AR	AL	....	232	160	232	190	....	NO	38HB	15HB
R-2800	240	AR	AR	AL	.080	200	147	215	....	....	....	40	....

PLUG DATA CHART—continued

7th Spark Plug and Ignition Conference

During Holding Procedure				Prior to Installation Are New Plugs					% Plugs Scrapped at Overhaul		
Min. Air Speed M. P. H.	Min. Engine Power	Min. F/A	Min. Head Temp. °C	Degreased?	Electrically Tested?	Gap Checked?	Is Anti-Seize Compound Used?	Is DC-4 Compound Used?	Due Core Nose Breakage	Due Barrel Breakage	Plugs Overhauled per Man Hour
140	....	....	93	NO	SPOT	NO	YES	NO	.5	1	50
120	400	.072	....	NO	NO	NO	YES	NO	2	2	17
....	....	....	....	NO	YES	YES	NO	YES	.15	.14	9.5
....	425	....	121	NO	NO	NO	YES	NO	....	....	....
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
130	....	....	....	YES	YES	YES	YES	NO	2	....	10
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
120	350	....	....	YES	YES	YES	NO	NO	2	2	4
130	480	AL	....	NO	YES	NO	YES	YES	.5	.1	25
120	....	....	230	NO	YES	YES	YES	YES	....	....	10
145	450	.072	....	NO	NO	NO	YES	NO	....	....	4
120	20" HG	....	149	YES	YES	YES	YES	NO	UND 1	UND 1	12
....	....	....	....	NO	NO	NO	YES	NO	....	2	4
120	550	....	120	YES	YES	YES	YES	NO	2	0	....
140	2050 RPM	....	135	YES	YES	NO	NO	NO	NEGL.	NEGL.	10
140	2050 RPM	....	135	YES	YES	NO	NO	NO	NEGL.	NEGL.	10
120	500	AL	....	YES	YES	YES	YES	NO	5	2	....
130	....	....	170	YES	NO	NO	YES	NO	NIL	NIL	16
....	....	....	....	NO	NO	NO	YES	NO	....	....	21
120	1700 RPM	....	158	YES	YES	YES	YES	NO	NIL	NIL	20
87	....	....	120	YES	YES	NO	NO	NO	2.5	1	12
87	....	....	120	YES	YES	NO	NO	NO	4.5	1	12
120	440	.076	170	NO	NO	NO	YES	NO	.5	.17	22
120	375	....	150	YES	YES	YES	YES	YES	.75	20	12
120	....	....	163	YES	YES	YES	YES	YES	.0015	.002	30
110	400	AL	150	YES	YES	YES	YES	YES	1	2	12
110	400	AL	150	YES	YES	YES	YES	YES	1	2	7
120	550	....	177	NO	NO	YES	YES	NO	.01	.4	8
125	475	....	120	NO	NO	SPOT	YES	NO	.5	1	12
....	....	....	....	....	....	....	....	....	....	....	....
110	....	....	232	YES	YES	YES	YES	YES	....	....	....
110	....	....	232	YES	YES	YES	YES	YES	....	....	....
....	450	.072	....	NO	NO	NO	YES	NO	....	....	4
120	425	AL	150	YES	YES	YES	YES	YES	1	2	12
120	425	AL	150	YES	YES	YES	YES	YES	1	2	7
....	....	....	....	NO	NO	NO	YES	NO	....	2	4
140	500	....	140	YES	YES	NO	YES	YES	4	.5	12
140	....	AL	....	NO	NO	NO	NO	NO	NEGL.	NEGL.	25
150	....	....	180	NO	SPOT	NO	YES	NO	.5	1	50
140	450	.064	150	NO	NO	NO	YES	NO	.25	.66	2
140	450	....	170	NO	YES	YES	YES	NO	NEGL.	NEGL.	25
130	400	....	150	YES	YES	NO	NO	NO	NEGL.	NEGL.	10
....	....	....	....	NO	NO	NO	YES	NO	UND 1	UND 1	21
140	1700 RPM	..	100	YES	YES	YES	YES	NO	NIL	NIL	20
145	500	AL	....	YES	NO	NO	NO	NO	.5	.5	15
140	....	....	....	YES	YES	YES	YES	NO	2	....	10
130	....	....	160	YES	YES	YES	YES	YES	.0015	.002	30
....	....	....	....	NO	YES	YES	NO	YES	.15	.14	9.5
140	....	....	150	YES	YES	YES	YES	NO	.01	.03	35
140	....	....	150	YES	YES	YES	YES	NO	.01	.03	35
....	550	....	121	NO	NO	NO	YES	NO	....	....	....
153	390	.065	....	YES	YES	YES	NO	NO	1	5	4.2
140	425	.066	....	YES	YES	YES	YES	YES	1	2	12
140	425	.066	....	YES	YES	YES	YES	YES	1	2	7
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
155	....	....	100	YES	YES	YES	YES	YES	....	....	....
155	....	....	100	YES	YES	YES	YES	YES	....	....	....
150	....	....	150	NO	SPOT	NO	YES	NO	.5	1	50
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
150	....	....	150	NO	NO	NO	YES	NO	.6	2.6	20
150	1900 RPM	....	175	NO	YES	NO	YES	NO	....	....	VABL.
140	....	AL	....	NO	NO	NO	NO	NO	NEGL.	NEGL.	25

1951 AIRCRAFT SPARK

From Champion Spark Plug Company's

Engine Model	Aircraft Model	No. Aircraft	Airline	Type Spark Plug Adopted as Standard	Original Gap Setting	High or Low Tension Ign. System	Water Injection	Avg. Gap Erosion Per 100 Hours	Max. Gap Allowed Before Removal (Overhaul)	Avg. Hours Total Plug Life	Max. CAA Approved Hours Before Removal (Overhaul)
R-2800	240	5	NEA	R37S-1	.013-.016	LOW	YES	.0015	....	1100	600
R-2800	240	12	KLM	R37S-1	.011-.014	HIGH[1]	YES	.0027	.024	820	....
R-2800	240	10	WAL	R37S-1	.011-.014	HIGH	YES	.0060	....	600	ON COND.
R-2800	240	6	SABENA	R37S-1	.011-.014	LOW	YES	....	....	800	....
R-2800	240	5	CAL	R37S-1	.013-.016	LOW	YES	.0035	....	660	....
R-2800	DC-6	49	AAL	R37S-1	.013-.016	LOW	NO	.0017	.025	800	ON COND.
R-2800	DC-6	6	PANAGRA	R37S-1	.013-.016	HIGH[1]	NO	.0030	.030	800	....
R-2800	DC-6	6	BAL	R37S-1	.013-.016	LOW	NO	.0015	....	800	650
R-2800	DC-6	7	KLM	R37S-1[6] RB19R-2	.011-.014	LOW	YES	.0008	.024	1000	....
R-2800	DC-6	8	NAL	R37S-1	.013-.016	HIGH	NO	.0025	.025	1000[4]	ON COND.
R-2800	DC-6	12	SAS	R37S-1	.011-.014	HIGH[1]	YES	....	....	....	....
R-2800	DC-6	7	DAL	R37S-1	.011-.014	LOW	....	....	....	....	ON COND.
R-2800	DC-6	5	SABENA	R37S-1	.011-.014	HIGH[1] LOW	YES	....	....	860	....
R-2800	DC-6	4	PIA	R37S-1	.011-.014	HIGH[1]	NO	.0017	....	NEW PLUGS ONLY	200
R-2800	DC-6A	1	SLICK	R37S-1	.015-.018	LOW	YES	....	....	....	ON COND.
R-2800	DC-6B	11	AAL	R37S-1	.013-.016	LOW	YES	.0021	.025	800	ON COND.
R-2800	DC-6 & DC-6B	50	UAL	R37S-1	.013-.016	HIGH[3] LOW	YES-19	....	....	....	ON COND.
R-2800	C-46	21	SLICK	R37S-1	.011-.014	HIGH	NO	.0020	....	800	300
R-2800	C-46	5	TAL	R37S-1	.013-.016	HIGH	NO	.0015	....	1020	400
R-2800	C-46	26	FLY TIGER	R37S-1	.011-.014	HIGH	NO	....	.017	500	280
R-2800	C-46F	6	US AIR LINES	R37S-1	.011-.014	HIGH	NO	.0030	....	1080	270
R-2800	C-46F	2	NAL	R37S-1	.013-.016	HIGH	NO	.0025	.025	600	300
R-3350	L-049	19	PAA-NAD	R37S-1	.013-.016	HIGH	NO	.0040	.030	NEW PLUGS ONLY	....
R-3350	L-049	5	CAP	R37S-1	.011-.014	HIGH	NO	.0040	....	450	260
R-3350	L-049	6	PANAIR DO BRASIL	R37S-1	.011-.014	HIGH	NO	.0040	.030	256[4]	....
R-3350	L-049	5	BOAC	RS19/2R	.011-.014	HIGH	....	....	....	900	....
R-3350	L-049	29	TWA	R37S-1	.011-.014	HIGH	NO	.0030	....	700[4]	....
R-3350	L-649A	6	C&S	R37S-1	.013-.016	LOW	NO	.0015	.028	612[4]	600
R-3350	L-749	20	EAL	R37S-1	.011-.014	LOW	NO	.0018	....	1300	700
R-3350	L-749	5	BOAC	RS19/2R	.011-.014	LOW	....	....	....	900	....
R-3350	L-749	23	AFA	R37S-1	.011-.014	LOW	NO	....	....	1000	....
				RB19R/2	.011-.014	LOW	NO	.0020	....	1000	....
R-3350	L-749	38	TWA	R37S-1	.011-.014	LOW	NO	.0015	....	700[4]	....
R-3350	L-749	18	KLM	R37S-1	.011-.014	LOW	NO	.0006	.024	1800	....
R-3350	C-121	..	MATS	R37S-1	.011-.014	LOW	NO	.0010	....	....	....
R-4360	B-377	10	NWA	R37S-1	.013-.016	HIGH[1]	YES	.0040	.030	340[5]	600
R-4360	B-377	7	UAL	R37S-1	.013-.016	HIGH[1]	YES	....	....	....	ON COND.
R-4360	B-377	16	PAA-NAD	R37S-1	.013-.016	HIGH[1]	YES	.0040	.030	NEW PLUGS ONLY	....
R-4360	B-377	11	PAA-PAD	R37S-1	.013-.016	HIGH[2]	YES	.0026	.030	900	ON COND.
R-4360	B-377	10	BOAC	RS19/2R	.011-.014	HIGH	....	....	....	900	....
R-4360	C-74	..	MATS	AC-181	.011-.014	HIGH[1]	NO	.0010	.014	....	....
R-4360	C-97A	..	MATS	AC-181	.011-.014	HIGH[1]	YES	.0010	.014	....	....
R-4360	C-124	..	MATS	AC-181	.011-.014	HIGH[2]	YES	.0010	.014	....	....
MERLIN 626/1763	ARGONAUT	22	BOAC	LR3R	.018-.021	HIGH	....	....	....	600	....
HERC.	HERMES IV	16	BOAC	LB3/2	.008-.010	HIGH	....	....	....	....	....
MERLIN 502	YORK	10	BOAC	RS5/7	.020	HIGH	....	....	....	600	....

Estimated figures are in **bold**.

[1] Pressurized ignition system.

[2] Magnetos pressurized.

[3] Distributors pressurized.

[4] This is average for all types of aircraft used by this Airline.

[5] New plugs used one run only and after overhaul installed R-2000.

[6] Ignition analyzer used to determine removals.

PLUG DATA CHART—continued

7th Spark Plug and Ignition Conference

Scheduled Hours Between Removals (Overhaul)	Actual Hours Between Removals (Overhaul)	Unsched. Plug Removals Per 1000 Eng. Hours	Lead Content in CC/US Gal.	Fuel Octane Rating	Average Number Take-offs per 100 Hrs.	Engine Power During			Engine Speed During		
						Take-off	Climb	Cruise	Take-off	Climb	Cruise
350	340	7.0	3.0	100	140	2400	1350	1000	2800	2300	2000
150	150	2.0	3.5	100/130	60	2400	1400	1000	2800	2400	2000
180	100	3.0	4.0	100	50	2400	1350	1000	2800	2300	2050
200	142	1.2	3.3	100/130	72	2400	1275	1090	2800	2400	2200
220	....	5.0	3.2	100/130	120	2400	1800	1050	2800	2300	2100
400	225	1.06	3.6	100	46	2100	1400	1100	2800	2450	2100
300	275	1.6	3.0	100/130	24	2100	1350	1100	2800	2450	2150
650	....	2.07	3.8	100	48	2100	1350	1100	2800	2450	2100
370[5]	370[5]	1.2	3.5	100/130	24	2400	1400	1000	2800	2400	2100
200	180	3.5	3.0	100	50	2100	1350	1000	2800	2450	2200
300	230	2.45	3.0	100/130	33	2400	1200	950	2800	2400	2050
300	300	3.7	3.7	100/130	50	2100	1400	1000	2800	2400	2150
250	149	2.54	3.3	100/130	21	2400	1370	950	2800	2400	2100
200	200	3.5	....	100/130	15	MAX.	75-87%	45-50%	2800	2450	2000-2150
300	300	0	4.0	100/130	22	2400	1500	1125	2800	2500	2300
400	225	1.06	3.6	100	46	2400	1600	1200	2800	2500	2300
200HT 400LT	136	4.4	3.0	100/130	43	2100-2400	1350	1000	2800	2250	2100
300	280	1.5	4.0	100	20	2000	1360	880	2700	2300	1900
350	330	3.0	3.93	100	17	2000	1175	950	2700	2300	1900
280	160.7	3.89	3.0	100/130	35	52"	37"	32"	2700	2300	1900
270	270	NEGL.	....	91 & 100	..	2000	68%	60%	2700	2300	1900
300	280	2.0	3.0	100	35	2000	1300	800	2700	2300	1900
275	250	7.0	3.5	100/130	23	2200	1450	1200	2800	2300	2150
130	125	4.3	3.8	100	75	2200	1400	1100	2800	2300	2170
400	180	8.3	4.0	100/130	21.3	2200	1400	1100	2800	2300	2150
100	...	3.0	2.9	.....	20	....	....	....	....	....	....
200	...	2.1	3.5	100/130	25	2200	1400	1100	2600	2400	2000
520	254	....	3.0	100/130	66	2500	1470	1200	2800	2300	2300
700	635	2.24	3.25	100/130	40	2500	1470	1400	2800	2300	2300
100	...	3.3	2.9	.....	16	....	....	....	....	....	....
500	400	3.0	3&4	100	14	2500	1450	1250	2800	2300	2150
500	400	3.0	3&4	100	14	2500	1450	1250	2800	2300	2150
400	...	2.3	3.5	100/130	25	2500	1470	1100	2800	2400	2000
650	650	1.9	3.5	100/130	20	2500	1470	1200	2800	2400	2125
200	200	....	4.6	100/130	10	2500	2100	1470	2800	2400	VABL.
340[5]	NEW-110 USED-71	NEW-1.5 USED-3.7	3.36	100	42	3250	2200	1675	2700	2350	2150
200	103	7.1	2.75	108/135	10	3500	2240	1675	2700	2350	2030
225	200	7.0	3.0	108/135	19	3500	2400	1750	2700	2425	2150
400	350	8.3	3.0	108/135	20	3500	2425	1750	2700	2350	2120
210	....	3.5	....	.....	20	....	....	....	....	....	....
200	100-125	....	4.6	115/145	8	3250	2030	1650	2700	2330	VABL.
200	100-125	....	4.6	115/145	8	3500	2650	1750	2700	2330	VABL.
200	100-125	....	4.6	115/145	8	3500	2650	1600	2700	2350	VABL.
200	150	1.4	3.9	.....	20	....	....	....	....	....	....
100	92-118	1.0	4.5	.....	20	....	....	....	....	....	....
150	120-150	1.0	4.5	.....	20	....	....	....	....	....	....

* From 6/22/51 R37S-1 installed front row and removed for new plugs at 370 hours. RB19R/2 installed rear row and removed for overhaul at 185 hours.

NOTE—In computing unscheduled plug removals it was considered that any part of the set, up to one complete set, would constitute one removal.

1951 AIRCRAFT SPARK

From Champion Spark Plug Company's

Engine Model	Aircraft Model	Mixture Control Position			Min. F/A Cruise	Maximum Allowable Head Temp. Climb °C	Minimum Climbing Air Speed M. P. H.	Allowable Head Temp. Cruise °C		Minimum Allowable Head Temp. Descent °C	Constant Carb. Air Temp.	Carburetor Air Temp. if not Constant °C	
		Taxi	Climb	Descent				Max.	Min.			Max.	Min.
R-2800	240	AR	AR	AR	AL	230	147	200	....	125	NO	38	5
R-2800	240	AR	AR	LEAN	....	220	170	....	190	150	NO	25	—30
R-2800	240	AR	AR	AL	....	235	160	235	200	150	NO	40	10
R-2800	240	AR	AR	AL	....	260	145	232	....	....	15	38	15
R-2800	240	AR	AR	AR	....	220	165	150	150	150	....	....	....
R-2800	DC-6	AR	AR	AR	.077	232	160	232	200	150	NO	....	....
R-2800	DC-6	AR	AR	AL	.070	200	160	180	....	....	....	40	....
R-2800	DC-6	AR	AR	AL-AR	BP	232	....	232	....	....	NO	....	....
R-2800	DC-6	AR	AR	LEAN	....	200	170	200	150	150	NO	20	..
R-2800	DC-6	AR	AR	AR	.078	232	170	232	200	....	NO	40	16
R-2800	DC-6	AR	AR	AL-AR	.067	230	160	230	190	190	NO	40	..
R-2800	DC-6	AR	AR	AL	....	260	160	232	150	150	NO	38	10
R-2800	DC-6	AR	AR	AL	....	260	160	232	....	....	15	38	15
R-2800	DC-6	AR	AR	AR	.062-.067	232	160	195	165	140	NO	15	—3
R-2800	DC-6A	AR	AR	AL	....	260	160	232	180	120	NO	38HB	NO
R-2800	DC-6B	AR	AR	AR	.075	232	160	232	200	150	NO	....	....
R-2800	DC-6 & DC-6B	AR	AR	ML	.065	232	156	232	160	160	NO	38	..
R-2800	C-46	AR	AR	AL	....	260	140	232	120	120	NO	50	..
R-2800	C-46	AR	AR	AR	....	220	145	200	150	150	NO	40	15
R-2800	C-46	AR	AR	AR	....	260	130	220	160	120	NO	....	....
R-2800	C-46F	AR	AR	AR	....	230	....	190	155	....	....	....	....
R-2800	C-46F	AR	AR	AL	.070	232	130	232	200	....	NO	40	15
R-3350	L-049	AR	AR	AL	.060	232	180	232	....	....	....	40	....
R-3350	L-049	AR	AR	AL	....	232	175	232	150	150	....	38	....
R-3350	L-049	AR	AR	AL	.063	232	184	232	....	....	NO	40	....
R-3350	L-049	....	....	....	....	....	....	....	....	....	....	....	....
R-3350	L-049	AR	AR	AL	....	232	185	232	....	....	NO	38	....
R-3350	L-649A	AR	AR	AL	....	232	175	232	....	....	NO	....	....
R-3350	L-749	AR	AR	AL	....	180	....	180	....	....	....	....	....
R-3350	L-749	....	....	....	....	....	....	....	....	....	....	....	....
R-3350	L-749	AR	AR-AL	AR	.060	180	175	165	....	165	NO	40	....
		AR	AR-AL	AR	.060	180	175	165	....	165	NO	40	....
R-3350	L-749	AR	AL	AL	....	232	175	232	....	....	NO	38	....
R-3350	L-749	AR	AR	ML	....	200	175	210	....	145	NO	40	....
R-3350	C-121	....	....	....	....	260	125	232	210	....	NO	38	15
R-4360	B-377	AR	AR	AL	.067	249	190	249	....	....	25	....	....
R-4360	B-377	AR	AR	ML	.065	249	200	232	160	160	25-35	38	10
R-4360	B-377	AR	AR	AL	.060	232	175	232	....	....	....	38	..
R-4360	B-377	AR	AR	AR	.060	249	160	232	210	180	25	....	....
R-4360	B-377	....	....	....	....	....	....	....	....	....	....	....	....
R-4360	C-74	....	....	....	....	228	130	210	200	150	NO	38	15
R-4360	C-97A	....	....	....	....	232	200	210	200	150	NO	38	7
R-4360	C-124	....	....	....	....	250	132	210	200	150	NO	38	15
MERLIN 626/1763	ARGONAUT	....	....	....	....	....	....	....	....	....	....	....	....
HERC.	HERMES IV	....	....	....	....	....	....	....	....	....	....	....	....
MERLIN 502	YORK	....	....	....	....	....	....	....	....	....	....	....	....

AAA—All American Airways.
AAL—American Airlines.
APA—Air France.
BAL—Braniff Airways.
BOAC—British Overseas Airways Corp.
C & S—Chicago & Southern Air Lines.
CAL—Continental Air Lines.
CAP—Capital Airlines.
CARIBAIR—Caribbean Atlantic Airline.
CPA—Canadian Pacific Airlines.
DAL—Delta Air Lines.
EAL—Eastern Air Lines.
EMPIRE—Empire Air Lines.
FAL—Frontier Airlines.
FAUCETT—Compania de Aviacion "Faucett"

PLUG DATA CHART—continued

7th Spark Plug and Ignition Conference

During Holding Procedure				Prior to Installation Are New Plugs					% Plugs Scrapped at Overhaul		
Min. Air Speed M. P. H.	Min. Engine Power	Min. F/A	Min. Head Temp. °C	Degreased?	Electrically Tested?	Gap Checked?	Is Anti-Seize Compound Used?	Is DC-4 Compound Used?	Due Core Nose Breakage	Due Barrel Breakage	Plugs Over-hauled per Man Hour
150	....	AL	....	NO	YES	NO	YES	YES	.5	.1	25
160	700	....	175	YES	YES	YES	YES	YES	.6	3.7	20
150	1800 RPM	....	100	YES	YES	YES	YES	NO	1	NIL	20
185	600	....	....	YES	YES	YES	NO	NO	0	12	7
....	....	....	....	NO	NO	NO	NO	NO	....	....	....
155	....	....	150	NO	NO	NO	YES	NO	.6	2.6	20
140	....	AL	....	NO	NO	NO	NO	NO	NEGL.	NEGL.	25
....	....	....	....	NO	NO	NO	YES	NO	UND 1	UND 1	21
150	700	....	150	YES	YES	YES	YES	YES	1	1	20
160	....	....	....	YES	YES	YES	YES	NO	2	....	10
....	....	....	....	NO	NO	YES	YES	YES	.83	.18	....
....	900	....	150	NO	NO	NO	YES	NO	....	....	....
174	506	....	....	YES	YES	YES	NO	YES	.3	10	7
165	43%	.062	165	NO	NO	NO	YES	YES	1	1	5
150	900	....	120	YES	YES	YES	YES	NO	....	....	....
150	....	....	150	NO	NO	NO	YES	NO	.6	2.6	20
145	....	....	160	YES	YES	YES	YES	YES	.0015	.002	30
130	630	....	120	YES	YES	YES	YES	NO	1	.2	15
140	....	....	150	NO	NO	NO	YES	NO	.25	.666	2
130	35.3%	....	160	YES	YES	YES	YES	NO	.01	.034	35
....	37.5%	....	....	YES	NO	YES	YES	YES	3	3	....
130	....	....	....	YES	YES	YES	YES	NO	2	....	10
140	....	AL	....	NO	NO	NO	NO	NO	NEGL.	NEGL.	....
150	....	....	150	NO	SPOT	NO	YES	NO	.5	1	50
130	....	.063	....	NO	NO	NO	NO	NO	....	....	4
....	....	....	....	....	....	....	....	....	.5	NEGL.	....
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
160	600	.062	....	NO	NO	NO	YES	YES	....	....	17
....	....	....	....	NO	YES	YES	NO	YES	.15	.14	9.5
....	....	....	....	....	....	....	....	....	.5	NEGL.	....
140	600	.060	130	YES	YES	YES	YES	YES	1	2	12
140	600	.060	130	YES	YES	YES	YES	YES	1	2	7
....	....	....	....	NO	NO	NO	NO	NO	.2	.3	....
185	800	....	....	YES	YES	YES	YES	YES	.1	.8	20
165	....	....	....	YES	YES	YES	YES	YES	....	....	....
175	1000	.065	....	YES	NO	NO	NO	NO	.5	.5	15
160	....	....	160	YES	YES	YES	YES	YES	.0015	.002	30
140	....	AL	....	NO	NO	NO	NO	NO	NEGL.	NEGL.	....
160	1200	....	180	NO	YES	YES	YES	NO	NEGL.	NEGL.	25
....	....	....	....	....	....	....	....	....	.5	NEGL.	....
130	....	....	200	YES	YES	YES	YES	YES	....	....	....
175	....	....	210	YES	YES	YES	YES	YES	....	....	....
132	....	....	150	YES	YES	YES	YES	YES	....	....	....
....	....	....	....	....	....	....	....	....	UMD 1	....	....
....	....	....	....	....	....	....	....	....	NEGL.	NEGL.	....
....	....	....	....	....	....	....	....	....	....	....	....

FL[illegible]TIGER—The Flying Tiger [illegible]ne.
H[illegible]AIR—Hawaiian Airlines.
KL[illegible]—Royal Dutch Airlines.
MA[illegible]—Military Air Transport [illegible]ervice.
MCA—Mid-Continent Airlines.
PIA—Philippine Air Lines.
PIO—Pioneer Air Lines.
SABENA—Sabena Belgian Airlines.
SAS—Scandinavian Airlines System.
SLICK—Slick Airways.
SWA—Southwest Airways.
TACA—TACA Airways.
TAL—Transocean Air Lines.
TCA—Trans-Canada Air Lines.
TWA—Trans-World Airlines.
SOUTHERN—Southern Airways.
UAL—United Air Lines.
U. S. Airlines.
WAL—Western Air Lines.

NOW in Production

Collins 51V Glide Slope Receiver

The design of the Collins 51V-1 receiver, now on the assembly line, is based on "Glide Slope Receiver Characteristics" issued by Aeronautical Radio, Inc.

This receiver, together with the Collins 51R navigation equipment, will fulfill ILS receiving requirements for commercial and private as well as military aircraft.

The 51V is designed for reception of 90/150 cps tone modulated glide slope signals on all ten present and ten planned channels in the UHF range of 329-335 megacycles. It utilizes crystals identical with those employed in R-89B receivers and is electrically and mechanically interchangeable with modified ten channel R-89B's, greatly simplifying installation in present aircraft.

The 51V receiver control circuits are integrated with the standardized R/theta channeling system, with channel selection provided by a Collins type 314U remote control unit.

Choice may be had of a dynamotor for 12 or 24 volt d-c operation or an a-c power unit for operation from 115 volt 400 cycle supply.

If you are not thoroughly acquainted with this new glide slope receiver from previous contact or correspondence, write us for the 51V illustrated descriptive bulletin.

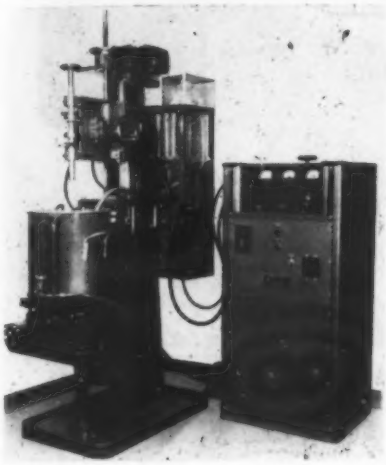
FOR PROGRESS IN INSTRUMENT LANDING SYSTEMS, IT'S . . .

COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 W. 42nd St., NEW YORK 18 1937 Irving Blvd., DALLAS 2 2700 W. Olive Ave., BURBANK

New Products



Milling Machine

A machine designed for use in working very hard metals such as sintered carbides, superalloys, and hardened steels, and which can be used to speed up the production of gas turbine blades, has been developed by the Method X Corp. of Philadelphia.

The manufacturer states that, while in current techniques gas turbine root mounting serrations and blade sections are shaped by slow grinding, milling, casting, and hammer forging, this metal-working can be quickly done with the Method X machine, because metal hardness has no effect on the machine's speed.

New machine can bore and tap sintered carbide die sections so that direct fastening to backing blocks with machine screws can be done. Complicated geometric shapes can be carved directly into hardest of metals, manufacturer states.

The machine action depends upon a mechanical rather than thermal effect of electricity which sets up internal stresses by use of high current densities. This causes metal particles to detach themselves from the work without melting.

Address: Mr. T. A. McLean, **Firth Sterling Steel and Carbide Corp.,** 3112 Forbes St., Pittsburgh 30, Pa.

Low-Speed Anemometer

An anemometer with a wind-speed threshold below one mile per hour and reading to 30 mph is available from Beckman and Whitley. Complete unit, which runs on its own battery, weighs 160 pounds.

Speed and direction recordings are made on separate, standard, pen type, 0-to-1 milliammeters not supplied in the standard system.

Manufacturer states that high resolution of output data permits wide choice of recorder chart speeds with flexibility in quantity of detail obtainable.

The equipment is portable, sealed, and permanently lubricated.

Address: **Beckman and Whitley, Inc.,** 904 San Carlos Ave., San Carlos, Calif.

Filler Cap

Production of a new pressure fuel filler cap for jet aircraft following service testing has been announced by Gabb Special Products.

Known as Safe-T-Lock, the new filler cap meets sealing requirements up to 100 p.s.i. It is flush mounted and will open safely under pressure, with tank vent valves eliminated. The cap opens by means of a lever action, requiring no tools.

Safe-T-Lock is designed to meet operational requirements of high-speed, high-altitude airplanes equipped with pressurized fuel tanks. Unit is self-contained with no detachable parts.

Address: **Gabb Special Products Division, The E. Horton & Son Co.,** Windsor Locks, Conn.

Small Potentiometer

Developed to overcome space and weight problems in guided missiles, a new type of potentiometer with two electrically separate sections is now being commercially produced by Electro-Mec Laboratory. The new device, which has a shaft torque of .013 ounce inches, is applicable to units such as aircraft instruments, in which an exceedingly small mechanical force must be converted into equivalent electrical voltages.

Current-carrying capacities up to 100 milliamperes provide two outputs sufficient to operate controlling and recording or indicating instruments simultaneously without amplification.

All parts are of non-corrosive materials or are protected by plating or anodic treatment.

Address: **Electro-Mec Laboratory,** 225 Broadway, New York 7, N. Y.

Metal Former

Kilham Engineering, Inc. has announced a new model metal-forming machine with a capacity to bend 15 inches of 18-gauge mild steel or the equivalent. Called "Bendit," the new model forms sheet, strip, and rod stock, as well as small tubing, into complex and simple shapes.

New machine was developed primarily for short-run production work, such as forming aircraft components. Provided with positive stops and gauges for accurate duplicating, the machine is said to eliminate need for expensive dies and tooling.

"Bendit" is designed to form any desired radius from 1/32″ to ⅝″. It handles metals of low ductility and plated or painted metals without fracture or injury to the surface where radius of bend is large enough to avoid cracking paint.

Interchangeable bending blades of soft steel are supplied, to be cut or sawed to size to meet job requirements. Actual bending is done by a hardened and ground steel roller.

Address: **Kilham Engineering, Inc.,** Plainville, Mass.

Valve Series

General Metals Corp. is marketing a series of new 3- and 4-way solenoid-operated valves, thermal relief valves, and check valves for pneumatic control systems in aircraft.

Address: **Adel Division, General Metals Corp.,** 10775 Van Owen Street, Burbank, Calif.

Hotel Lexington
LEXINGTON AVENUE AT 48th ST., N. Y. C. 17
HOME OF THE Hawaiian Room

WHEREVER YOU GO
WHATEVER YOU FLY
ARC EQUIPMENT

Meets Your Operational Needs

ARC Type 11A meets basic needs by providing VHF transmission, LF range reception suitable for the exacting requirements of night instrument operation, and rotatable loop navigation.

ARC Type 17 is 2-way VHF equipment, including tunable VHF receiver and one or more 5-channel, crystal controlled VHF transmitters.

ARC Type 12 (illustrated) gives you advantages of both Type 11A and Type 17 systems.

All ARC airborne equipment is designed for reliability and performance, not to meet a price.

AIRCRAFT RADIO CORPORATION
Boonton New Jersey
Dependable Electronic Equipment Since 1928

Extra Section

By William D. Perreault

THE technical aspects of a tour through any of the NACA laboratories are extremely pleasing. Without question NACA outperforms any other organization in handling big groups of people graciously and effectively. There were about 1,500 visitors at the Lewis Flight Propulsion Laboratory during the three-day inspection program described in this issue. Exhibits are such that virtually everyone

can understand the complex research activities described. During this most recent inspection a number of us had the unusual experience of operating a ramjet engine and watching pressure and temperature gauges while the engine roared away at close to 5,000 pounds thrust and, on a televised Schlieren photo, we could watch supersonic shock waves break across the engine inlet. So we're now official ramjet operators.

•

Champion has designed a gimmick known as "Oscar, Jr." which would make it possible to train pilots in the complex relationship between engine operating variables and spark plug temperatures, an index to spark plug and ignition difficulties. Slightly larger than a portable typewriter, "Oscar, Jr." has a master dial showing operating temperature of the spark plug insulator nose tip and center electrode (clearly marked as normal or dangerous) as small knobs are turned varying spark advance, manifold pressure fuel/air ratio, intake pipe air temperature, engine rpm, cylinder head temperature and exhaust back pressure. Champion is surveying the airlines to determine possible interest in purchasing such a unit for pilot training.

•

One of the common criticisms of pilot personnel is that they know too little about the engineering side of the aviation business. Someone is always ready to attribute general aircraft malfunctions to "cockpit trouble" resulting from this shortcoming. At Champion Spark Plug Company's conference this year it was again suggested by one engineer that pilot operating procedure is the core of many problems and pilots should be educated about these ignition matters. Ray Farren, Trans Canada Airlines' expert on ignition, defended the pilots with an interesting statement. He suggested that better over-all results could be attained by having more engineers with first-hand pilot experience than vice versa. Farren noted that engineer-pilots would never design some of the equipment regular pilots are now expected to handle.

Connector Problem?

...We'll take it from HERE

Good ideas for electronic circuitry sometimes run afoul of connector problems. Maybe existing connector units won't hold air pressure gradients, won't stand the heat, aren't rugged enough for the job. Or maybe it's a question of altitude, or under-water application. But if you can sketch the circuit, we'll take it from there. We've engineered so many special connectors, solved so many "impossible" problems, that whatever the requirements are, we can usually provide the answer.

Lightweight actuators for any requirement.

Job engineered, welded-diaphragm bellows.

Flexible conduit and ignition assemblies.

Aero-Seal vibration-proof hose clamps.

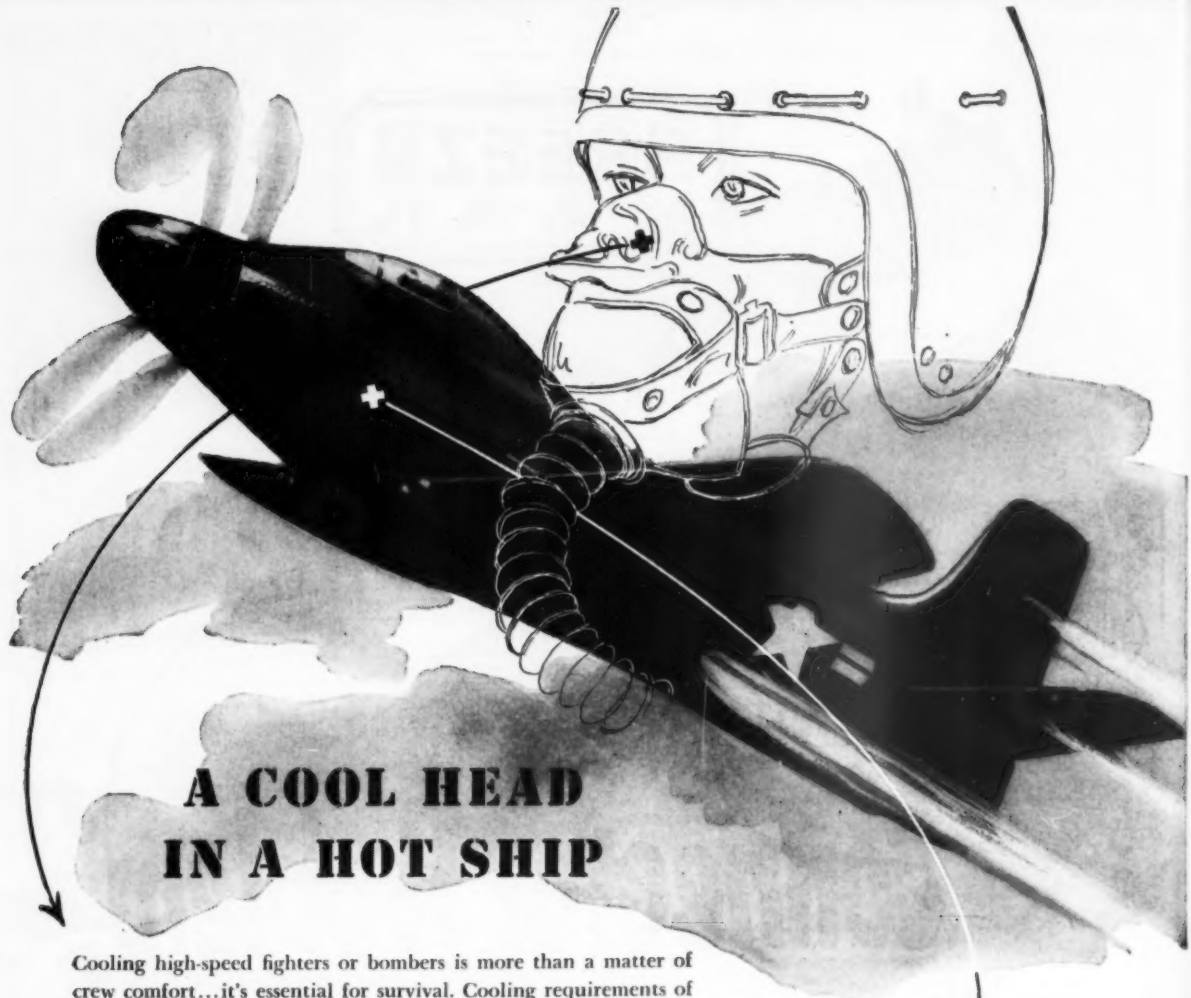
WRITE TODAY for specific information, or send us your sketches. We'll forward recommendations promptly.

BREEZE
Special CONNECTORS

BREEZE CORPORATIONS, INC.

41 South Sixth Street Newark, New Jersey

Removable pins in Breeze connectors speed soldering, save time, trouble. Pins snap back into block.



A COOL HEAD IN A HOT SHIP

Cooling high-speed fighters or bombers is more than a matter of crew comfort...it's essential for survival. Cooling requirements of combat aircraft are severe. Highly efficient, compact and light-weight refrigeration units are needed to keep cockpit temperatures at desirable levels.

Stratos air cycle cooling units are *engineered* to meet these exacting demands. Extremely compact and very light, they deliver a high rate of flow of cooling air. Production models with air flow capacity ranging from 12 lb/min to 90 lb/min are standard equipment in combat aircraft of the U. S. Navy and the U. S. Air Force. Such high performance aircraft as McDonnell's F2H2 Banshee, Boeing's B-47 Stratojet, North American's AJ-1 Tornado, and the Douglas XA2D Skyshark are equipped with Stratos cooling packages.

Airlines, too, are using Stratos equipment in transport aircraft such as the Constellations of Pan American World Airways, and the Convair Flagships of American Airlines, in which Stratos equipment has proved its efficiency, low maintenance cost, and long period of service between overhauls.

Air cycle cooling package

OTHER STRATOS EQUIPMENT:

- Cabin Superchargers
- Mass Flow Valves
- Emergency Disconnects for Accessories
- Temperature Control Valves
- Flow Control Equipment

For information on this and other Stratos equipment, write:

Stratos DIVISION
FAIRCHILD ENGINE & AIRPLANE CORP.

Main Office and Plant: Farmingdale, Long Island, N. Y. • West Coast Office: 1907 Westwood Blvd., Los Angeles 24, Calif.
Fairchild Aircraft Division, Hagerstown, Md. • Fairchild Engine and Guided Missiles Division, Farmingdale, N. Y.

UNITED AIR LINES HAS RESHUFFLED top operations and maintenance personnel "to increase efficiency and to provide closer direction of the company's operations organization." J. A. Herlihy, right, former vice president-operations, is now v.-p.-engineering and maintenance. D. F. Magarrell, center, former v.p.-passenger service, is v.p.-transportation services, taking over ground services in addition to in-flight passenger service. D. R. Petty, right, is now v.-p.-flight operations.

Dividend Payments by Domestic Airlines

Calendar Years 1938-1950

(in thousands)

Carrier	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Trunk Lines													
American	0	0	$422	$1,075	$1,075	$1,075	$1,431	$1,290	$ 649	$1,400	$1,400	$1,400	$3,013
Braniff	0	0	0	0	0	650	600	600	450	0	0	0	250
Capital	0	0	0	0	92	83	21	119	0	0	0	0	0
Chicago & Southern	$37	$39	23	17	163	123	36	77	0	0	0	178	255
Colonial	0	0	0	0	0	0	0	0	0	0	0	0	0
Continental	0	0	0	0	3	3	40	41	41	0	0	0	77
Delta	31	20	35	0	99	99	99	598[1]	200	0	0	125	250
Eastern	0	0	0	0	0	0	0	597	1,198	599	0	0	599
Inland	0	0	0	0	0	0	0	0	0	0	0	0	0
Mid-Continent	0	5	0	0	0	0	0	0	0	0	97	199	208
National	0	0	0	0	0	0	97[2]	0	100[2]	0	0	0	0
Northeast	0	0	0	0	0	0	0	0	0	0	0	40	79
Northwest	1	4	2	0	117	117	178	270	272	218	112	224	111
Trans World	0	0	0	0	0	0	0	0	0	0	0	0	0
United	0	0	0	0	0	750	1,178	1,209	1,033	320	107	213	1,971
Western	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-total	**$68**	**$59**	**$482**	**$1,092**	**$1,549**	**$2,900**	**$3,680**	**$4,801**	**$3,943**	**$2,537**	**$1,716**	**$2,379**	**$6,813**
Local Service Lines													
All American	.....	.....	0	0	0	0	$ 28	0	0	0	0	0	0
Bonanza	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Central	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Empire	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0	0
Frontier	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0	0
Lake Central	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	6
Mid-West	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Ozark	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Piedmont	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	$ 11
Pioneer	.....	.....	.....	.....	.....	.....	.....	0	0	0	0	$ 23	50
Robinson	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0
Southern	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Southwest	.....	.....	.....	.....	.....	.....	.....	.....	0	0	$ 311[2]	0	0
Trans Texas	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0
West Coast	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0	0
Wiggins	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Wisconsin Central	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0
Sub-total	.....	.....	0	0	0	0	$ 28	0	0	0	$ 311	$ 23	$ 61
Helicopter Lines													
Helicopter Air Service	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	$ 19
Los Angeles Airways	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0
Sub-total	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	$ 19
Total—All Carriers	$68	$59	$482	$1,092	$1,549	$2,900	$3,708	$4,801	$3,943	$2,537	$2,027	$2,402	$6,893

[1] Cash dividend $200,000; stock dividend $398,000

[2] Stock dividend.

IN [illegible] YEARS—1938 THROUGH 1950—$32,461,000 has been paid in dividends on common and preferred stock by U. S. domestic sch[illegible]led airlines. Over $6 million, nearly one-fifth, was paid out in 1950. American Airlines has paid the most in total dividends, $1[illegible]0,000. American's 1950 payment of $3,013,000 amounted to 43% of the total of all dividends paid that year.

International Revenues, Expenses, First Half 1950-51, Compared

AIRLINES	TOTAL OPERATING REVENUES	PASSENGER REVENUES	U. S. MAIL REVENUES	FOREIGN MAIL REVENUES	EXPRESS REVENUES	FREIGHT REVENUES	EXCESS BAGGAGE REVENUES	NON-SCHEDULED TRANSPORT REV.	TOTAL OPERATING EXPENSES	AIRCRAFT OPERATING EXPENSES	GROUND & INDIRECT EXPENSES	NET OPERATING INCOME
American	$ 2,545,384	$ 2,173,892	$ 58,237	$ 46,413	$ 1,621	$ 166,453	$ 33,943	$	$ 2,269,180	$ 1,199,060	$1,070,120	$ 276,204
1950	1,948,372	1,650,825	43,494	33,012	1,866	129,537	25,248	2,952	1,966,351	1,045,218	921,133	-17,980
AOA	PAA-AOA merger was effective September 25, 1950.											
1950	10,673,439	7,257,312	2,010,404	595,060	618,695	. . . .	77,761	65,087	12,128,173	6,486,563	5,641,610	-1,454,734
Braniff	3,560,131	2,233,167	1,030,893	44,516	. . . .	184,490	52,830	. . . .	3,430,228	1,577,485	1,852,742	129,903
1950	2,405,609	1,323,744	922,073	18,201	. . . .	100,069	38,920	. . . .	2,448,634	1,109,002	1,339,632	-43,024
C & S	1,982,653	1,080,111	751,109	4,182	. . . .	96,659	37,671	. . . .	1,756,222	849,863	906,360	226,431
1950	1,909,758	1,014,213	747,932	5,822	. . . .	92,048	36,501	. . . .	1,904,867	949,113	955,754	4,891
Colonial	1,028,511	869,600	133,566	7,624	. . . .	4,431	5,081	3,487	845,108	351,637	493,472	183,402
1950	516,246	419,205	77,069	3,511	. . . .	7,165	1,117	. . . .	582,179	220,562	361,617	-65,933
Eastern	1,515,300	1,306,042	127,645	. . . .	. . . .	23,406	19,965	38,250	1,563,138	1,022,685	540,454	-47,839
1950	629,527	416,047	24,640	. . . .	. . . .	35,955	4,365	148,520	523,702	269,230	254,471	105,825
National	1,079,028	988,817	34,224	. . . .	9,228	29,900	13,309	3,550	1,332,044	496,378	835,666	-253,017
1950	791,993	715,830	14,072	. . . .	49,569	. . . .	11,387	1,135	833,702	306,145	527,557	-41,710
Northwest	7,642,293	3,977,214	1,900,233	331,271	30,256	1,234,908	40,061	20,991	6,631,230	3,164,136	3,467,094	1,011,062
1950	6,782,556	2,835,812	2,738,399	232,049	17,936	846,759	28,710	67,053	5,462,720	2,703,563	2,759,157	1,319,836
Panagra	8,481,058	5,551,155	1,548,876*	333,602	449,990	. . . .	188,053	195,739	7,049,257	3,135,612	3,913,644	1,431,801
1950	7,429,380	4,645,010	1,896,090*	331,065	341,184	. . . .	157,003	28,480	6,802,886	3,231,348	3,571,538	626,493
Pan American Latin Amer.	31,671,711	21,964,019	3,613,500	1,007,272	2,008,811#	1,921,249#	539,163	240,427	30,981,298	13,520,981	17,460,317	690,413
1950	29,297,515	18,977,996	4,551,404**	919,499	3,512,867	. . . .	519,803	456,404	28,669,366	12,691,476	15,977,890	628,149
Atlantic	23,808,027	17,490,350	6,828,091	1,241,369	1,044,713#	1,201,339#	305,884	443,351	30,670,451	15,413,064	15,257,387	-1,862,424
1950	24,400,659	11,941,451	9,663,407**	1,009,950	1,431,914	. . . .	237,821	60,718	22,724,746	11,568,234	11,156,513	1,675,913
Pacific	16,817,027	8,903,405	5,835,915	425,312	549,707#	730,721#	110,481	58,845	13,610,024	8,024,297	5,585,727	3,207,003
1950	17,524,224	7,236,936	8,337,793**	620,337	934,224	. . . .	80,576	165,453	15,750,876	8,504,857	7,246,019	1,773,348
Alaska	2,743,341	1,427,127	645,878	. . . .	210,283#	322,705#	10,304	120,195	2,400,205	1,139,437	1,260,768	343,136
1950	2,425,174	1,107,099	748,730**	. . . .	451,554	. . . .	7,467	108,494	2,277,214	1,081,151	1,196,063	147,960
TWA	22,205,698	13,189,270	4,428,892##	1,633,939	. . . .	1,264,108	246,497	458,666	19,995,079	9,421,975	10,573,104	2,210,620
1950	19,079,346	11,450,097	4,513,816##	1,504,531	. . . .	1,132,458	259,600	33,672	17,561,787	8,927,070	8,634,717	1,517,560
United ***	4,384,738	2,478,654	296,605	. . . .	. . . .	73,945	15,642	. . . .	4,764,823	2,898,365	1,866,457	-380,084
1950	2,050,471	1,686,511	217,523	. . . .	. . . .	57,410	10,094	. . . .	3,066,536	1,931,934	1,134,601	-1,016,065
TOTALS	134,464,900	83,632,823	27,236,664	5,075,500	4,304,609	7,254,314	1,618,884	1,583,501	127,298,287	62,214,975	65,083,312	7,166,611
1950	127,864,269	72,728,088	36,506,846	5,273,037	7,361,809	2,401,401	1,496,373	1,137,968	122,703,739	61,025,466	61,678,272	5,160,529

* U.S. mail pay accrued on the basis of show cause order dated April 12, 1949, which accrual exceeds amounts payable under temporary rate order by $994,089 for the six months ending June 30, 1950 and by $248,319 for the six months ending June 30, 1951.

** Represents company's estimate of amount which should be received in accordance with the terms of the Civil Aeronautics Act when permanent rates are established. Estimate exceeds temporary rates in effect by: $941,110 for LAD; $4,839,795 for Atlantic Div. $2,500,077 for Pacific Div.; $117,517 for Alaska Div.

\# PAA's divisions switched express revenues to freight revenues column in second quarter, 1951.

\#\# U.S. mail revenues computed at temporary rates in effect prior to issuance of CAB show cause orders proposing reductions in rates of compensation to company for carriage of mail on its international routes.

*** UAL pilot strike from June 19 to June 29, 1951.

NOTE: Data in above tabulations were compiled by American Aviation Publications from reports filed by the airlines with the Civil Aeronautics Board. Figures for American Airlines include that carrier's service to Mexico but not to Canada; for Braniff to South America; C & S to South America; Colonial to Bermuda; Eastern to Puerto Rico; National to Havana; Northwest to Orient and Honolulu, and United to Honolulu. Operations of U.S. carriers into Canada are included in domestic reports to CAB, in accordance with CAB filing procedures.

International First-Half Income Up 38.8% . . .

THE eleven U. S. international and overseas carriers operating this year showed a combined net operating income of $7,166,611 for the first six months, which was 38.8% greater than the $5,160,529 operating net earned by twelve carriers in the corresponding period of 1950, according to reports filed with the Civil Aeronautics Board. This gain was made despite a reduction of over $9 million in mail revenues.

Mail pay, both U. S. and foreign, ran $9,467,719 under the 1950 first-half payments, dropping from $41,779,883 to $32,312,164, a decline of 22.6%. U. S. mail revenues this year were 25.3% less than in the first six months of 1950, $27,236,664 vs. $36,506,846, and foreign mail payments dropped from $5,273,037 to $5,075,500, a 3.7% decrease. The $41,779,883 in mail pay January-June, 1950, amounted to over 32% of the carrier's gross revenues whereas for the first six months of this year it was only $32,312,164 or 24% of gross revenues.

Passenger revenues of the internationals totaled $83,632,823 for the first half of this year and amounted to 62% of total revenue. In the like 1950 period, passenger revenues were $72,728,088, or only 56% of total revenue. Six-month increase in passenger revenues this year was $10,904,735, a gain of 14.9%

Combined express and freight revenues were $11,558,923 for the first half, up 18.3% from the $9,763,210 attained the year before. A change in practice of certain carriers in reporting individual express and revenue figures necessitates reporting in combination for retention of a balanced picture—otherwise an unrealistic and excessive loss or gain would be shown in one or the other category.

Other revenue of the internationals, including excess baggage revenues and non-scheduled activities, produced $3,202,385 through June this year, while only $2,634,341, was received from the same source.

Total operating revenues of the group were $134,464,900, up 5.1% from the $127,864,269 for the first six months of 1950. Expenses rose 3.7% from $122,703,739 to $127,298,287. Gain in total revenue, out-stripping the rise in expenses, accounted for the $2,006,082 increase in net operating income.

International Airline Traffic, Second Quarter, 1950-51, Compared

AIRLINES	REVENUE PASSENGERS	REVENUE PASSENGER MILES	AVAILABLE SEAT MILES	PASSENGER LOAD FACTOR	U. S. MAIL TON-MILES ***	FOREIGN MAIL TON-MILES	EXPRESS TON-MILES	FREIGHT TON-MILES	TOTAL TON-MILES REV. TRAFFIC	AVAILABLE TON-MILES FLOWN	% AVAILABLE TON-MILES USED	REVENUE PLANE-MILES	SCHEDULED MILES	% SCHEDULED MILES COMPLETED
				%										
American	27,591	20,011,000	35,435,000	56.47	38,442	13,269	2,200	430,744	2,604,492	4,593,216	56.70	710,785	705,105	100.00
1950	21,377	15,410,000	27,850,000	55.33	27,887	8,358	2,919	325,211	2,004,689	3,686,193	54.36	553,050	533,154	99.83
AOA	PAA-AOA merger was effective September 25, 1950.													
1950	35,399	56,968,000	87,546,000	65.07	501,413	151,752	714,173	. . . .	7,581,917	11,684,239	64.88	1,698,799	1,665,823	96.71
Braniff	6,951	14,923,000	35,537,000	41.99	29,164	9,435	. . . .	414,392	1,921,025	5,241,131	36.65	798,609	794,833	99.99
1950	4,441	9,613,000	26,742,000	34.94	8,784	3,366	. . . .	283,789	1,231,843	3,787,312	32.50	626,721	627,405	99.89
C & S	6,177	7,736,000	19,388,000	39.90	8,758	1,186	. . . .	161,992	977,926	2,701,828	36.19	421,816	422,422	99.86
1950	5,725	6,882,000	19,906,000	34.57	7,093	1,033	. . . .	143,190	861,304	2,380,637	36.18	492,904	504,861	96.95
Colonial	12,353	9,639,000	10,915,000	88.31	5,516	1,646	. . . .	7,723	1,043,522	1,311,920	79.54	209,907	181,996	99.94
1950	5,800	4,726,000	7,253,000	65.16	1,210	1,530	. . . .	25,992	529,943	945,832	56.02	151,333	136,929	99.80
Eastern	16,845	23,688,000	52,761,000	44.90	136,705	. . . .	. . . .	70,086	2,733,505	8,276,913	33.02	908,202	903,243	98.40
1950	5,264	8,418,000	14,701,000	57.26	21,096	. . . .	. . . .	81,071	976,194	1,723,122	56.65	274,116	189,280	96.75
National	24,196	6,411,000	17,145,000	37.39	3,474	5	2,535	86,238	744,412	2,294,724	32.44	316,295	309,188	98.95
1950	18,991	5,172,000	10,500,000	49.25	2,922	. . . .	56,707	. . . .	584,428	1,322,054	44.20	183,304	187,446	93.73
Northwest	20,277	33,698,000	61,614,000	54.69	413,501	132,014	62,571	3,825,964	6,019,215	9,176,303	65.59	1,627,790	1,507,810	98.92
1950	15,262	28,659,000	50,151,000	57.14	540,705	74,933	40,659	4,504,042	5,249,403	8,168,868	64.26	1,723,143	1,447,130	99.58
Panagra	28,994	29,937,000	53,178,000	56.29	112,371	65,257	619,828	. . . .	4,119,123	7,427,850	55.45	1,475,177	1,447,343	98.46
1950	23,884	24,996,000	55,018,000	45.43	93,210	55,687	426,832	. . . .	3,337,607	7,392,827	45.14	1,440,294	1,442,269	98.33
PAA														
Latin Amer*	194,038	169,778,000	291,520,000	58.24	736,325	170,583	3,999,069	4,983,037	23,484,222	39,456,139	59.52	7,149,189	5,629,759	99.46
1950	165,643	148,496,000	249,691,000	59.47	692,953	185,490	4,968,792	423,629	21,094,467	39,562,962	53.32	7,133,082	6,159,745	98.68
Atlantic	93,416	133,698,000	197,186,000	67.80	1,261,938	317,100	2,920,609	126,891	19,224,120	25,506,617	75.37	4,049,415	4,121,465	96.36
1950	44,093	91,849,000	126,210,000	72.77	805,138	227,144	2,036,127	. . . .	13,160,056	19,721,396	66.73	3,213,139	3,118,906	97.43
Pacific	21,537	73,819,000	113,477,000	65.05	1,204,622	102,332	1,798,381	. . . .	10,583,685	16,497,798	64.15	2,318,179	2,243,092	99.80
1950	20,509	60,434,000	108,085,000	55.91	1,587,252	183,714	1,226,375	27,749	9,196,993	16,321,168	56.34	2,495,759	2,338,519	99.80
Alaska	15,270	16,647,000	35,961,000	46.29	114,163	. . . .	1,417,586	11,368	3,283,164	5,789,666	56.71	849,578	664,937	99.75
1950	11,665	11,845,000	21,328,000	55.53	98,757	. . . .	1,115,406	5,870	2,461,263	4,790,794	51.37	709,675	603,190	99.80
TWA	39,596	98,005,000	141,369,000	69.32	1,025,483	386,952	. . . .	1,599,577	13,751,837	20,323,671	67.66	3,362,193	3,277,068	98.27
1950	32,797	88,453,000	141,552,000	62.48	745,608	335,049	. . . .	1,389,574	12,178,064	19,614,460	62.08	3,517,938	3,481,010	98.68
United **	9,534	23,543,000	36,786,000	64.00	183,595	. . . .	. . . .	110,224	2,797,560	4,882,996	57.29	703,500	517,252	86.07
1950	7,138	17,131,000	25,613,000	66.88	153,029	. . . .	. . . .	72,502	2,055,806	3,366,467	61.05	477,620	468,020	100.00
TOTALS	516,775	661,533,000	1,102,272,000	60.01	5,274,057	1,199,779	10,822,779	6,828,286	93,287,808	153,480,772	60.78	24,900,635	23,025,613	98.20
1950	417,988	579,052,000	972,146,000	59.56	5,287,057	1,228,056	10,587,990	4,282,619	82,503,977	144,468,331	57.10	24,690,877	22,923,687	98.46

* PAA's LA Division switched express ton-mile figure to freight column in June, 1951.
** UAL pilot strike from June 19 to June 25, 1951. *** Includes air parcel post.

NOTE: Figures include both scheduled and non-scheduled operations. Data in above tabulations were compiled by American Aviation Publications from monthly reports filed by the airlines with the Civil Aeronautics Board. Figures for American Airlines include that carrier's service to Mexico but not to Canada; for Braniff to South America; C & S to South America; Colonial to Bermuda; Eastern to Puerto Rico; National to Havana; Northwest to Orient and Honolulu, and United to Honolulu. Operations of U.S. carriers into Canada are included in domestic reports to CAB, in accordance with CAB filing procedures.

. . . Second-Quarter Traffic Gains 14%

REVENUE passenger-miles of U. S. flag international and overseas airlines increased 14% during the second quarter of 1951 over the same period a year ago, according to reports filed with the Civil Aeronautics Board. Revenue passenger-miles increased from 579,052,000 flown in the three-month, April-June period of 1950, to 661,533,000 in the same three months this year.

The eleven carriers operating this year flew 516,775 revenue passengers at an average load factor of 60%, as against 417,988 revenue passengers flown by twelve airlines operating at the same time last year (at a 59.5%) passenger load factor. The increase in total number of passengers carried was 23.6%.

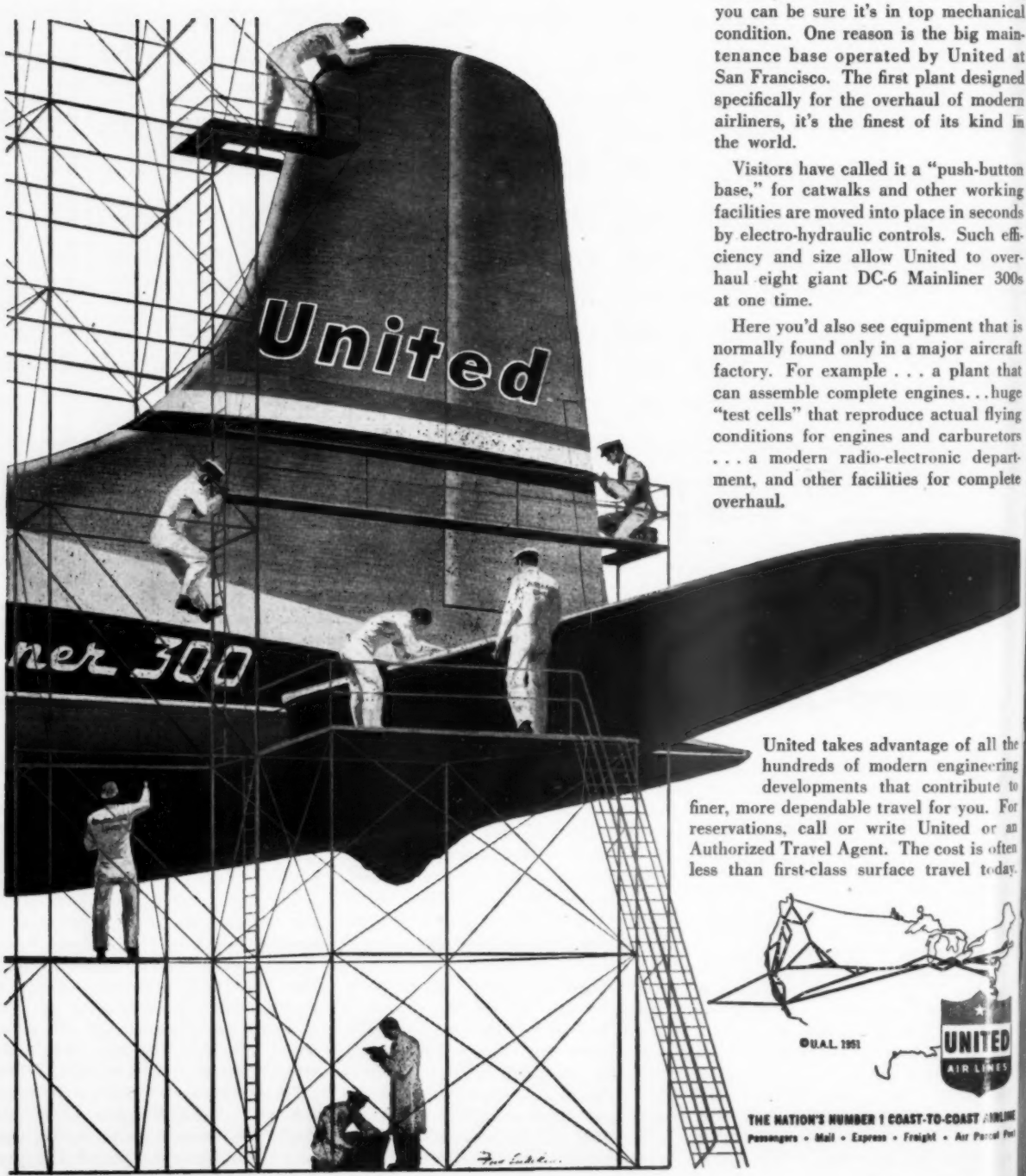
American Overseas Airlines, which later merged with Pan American World Airways, flew 35,399 revenue passengers in the second quarter of 1950 while its American competitors, Pan American Atlantic Division and TWA, handled 44,093 and 32,797 passengers, respectively. In the second quarter of 1951, the enlarged Atlantic Division, result of the PAA-AOA merger, more than doubled its revenue passenger total to 93,416.

TWA's passenger traffic rose to 39,596 passengers for the period, a gain of 20.7% and nearer the group's average gain. Eastern Air Lines was the biggest gainer of the group in the number of passengers carried, raising its passenger total from 5,264 to 16,845.

Air cargo still held its position as the most rapidly growing service, with freight ton-miles up 59.4%, 6,828,286 in the April-June, 1951, quarter, versus 4,282,619 in the same three months of 1950. Ton-miles of express were 10,822,779 as compared with 10,587,990, a gain of 2.2%.

The ton-miles of mail, both U. S. and foreign, were 6,473,836 as compared with 6,515,113, a .6% decline. Where U. S. mail is concerned alone, figures show 5,274,057 ton-miles flown as against 5,287,057, a decrease of .2%, whereas foreign mail fell off 2.3%, down from 1,228,056 ton miles in the second quarter of 1950 to 1,199,779 ton-miles in the same three-month period this year. Total ton-miles of revenue traffic flown were 13% more than were carried in the same period last year.

Maintenance in the Mainliner Manner



When you board a United Mainliner, you can be sure it's in top mechanical condition. One reason is the big maintenance base operated by United at San Francisco. The first plant designed specifically for the overhaul of modern airliners, it's the finest of its kind in the world.

Visitors have called it a "push-button base," for catwalks and other working facilities are moved into place in seconds by electro-hydraulic controls. Such efficiency and size allow United to overhaul eight giant DC-6 Mainliner 300s at one time.

Here you'd also see equipment that is normally found only in a major aircraft factory. For example . . . a plant that can assemble complete engines. . . huge "test cells" that reproduce actual flying conditions for engines and carburetors . . . a modern radio-electronic department, and other facilities for complete overhaul.

United takes advantage of all the hundreds of modern engineering developments that contribute to finer, more dependable travel for you. For reservations, call or write United or an Authorized Travel Agent. The cost is often less than first-class surface travel today.

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Airline Commentary

By Eric Bramley

SORRY we haven't been able to get to this sooner, but we recommend to you an article, "Airline-Agency Relations—and How to Improve 'Em." in the Sept. 10 *Travel Agent*. It's by **Bill Beattie,** Braniff's agency, interline and tour manager, and is informative and humorous.

He talks, for example, about "that maligned product of merchandising, the cocktail party." He says parties are okay if handled right—if you have a new program to explain, the group is small, etc.

But, he adds, the trend is: "Don't worry about being original, or generating something bigger or different. Just throw a cocktail party, the bigger and noisier the better, and pronto! you're an operator.

"Ed Sullivan of TWA, who is no piker, and I put the cocktail party to the acid test at the Mexico (ASTA) convention which . . . was on the lavish side. It was all friendly and everyone was 'inspired' including Sullivan and me.

"So we posted ourselves outside the door of the huge daily cocktail party of one of our competitors, Sullivan working one side of the double door, me working the other. Gradually, but with budgeted finality, the bar was shut off and the guests, the cream of the travel business, streamed out looking for more cocktails to conquer.

"As they passed through the doors, Sullivan told everyone on his side, 'TWA was certainly happy to have had you with us.' On my side I was pitching, 'Braniff was most happy to have had you with us.' We were doing great and being overcome with overripe thanks until one belligerent bruiser collared Sullivan and stormed, 'So it's TWA, the lousy pikers, who shut off the Scotch at 9 o'clock!'

"Sullivan and I beat hasty retreats to our respective likker lairs, opened the doors and announced, 'Come and get it!' Later we wondered who was that guy. Neither of us had seen him before or since. Maybe he just came. I hope he's gone."

Bill also has choice comments on free trips for agents, airline agency men, etc. It's good reading.

•

A celebration is in order. A number of times, and to no avail, we have pleaded with airlines to furnish bibs for use of passengers at meal time. Some progress has now been made—not because of our pleadings, but it's progress nevertheless.

United Air Lines tells us that "etiquette experts have okayed the bib method for dining on planes and United has launched a campaign to get napkins under the chin and keep the vest from getting all the gravy.

"To prompt passengers into bibbing, Mainliner meal trays carry a cartoon of a diner with a napkin tied 'round his neck and labeled *'La serviette au cou*—it may prevent a spot or two.' *Serviette au cou* is French for 'napkin on the neck'."

Yes, this is progress. Only suggestion we would make is that a real bib be furnished. It stays on better than a napkin.

•

A few weeks ago, the city council of Alexandria, Va., passed an ordinance forbidding planes to fly at an altitude of less than 1,000 ft. when passing over the city. Inasmuch as Alexandria is adjacent to Washington National Airport, the council's action is important. CAA appeared at the meeting and allowed as how it would be better if the council didn't do such a thing. Air Line Pilots Association objected, but the city fathers had made up their minds, and that was that. Period.

At about this time, Milt Arnold, vice president-operations and engineering of Air Transport Association, happened to be in England for the big Farnborough show. He was amused to discover that the same problem exists over there, but it's handled in a slightly different manner. The London press reported that the Residents' Association of Coulsdon, Surrey, complained to the Ministry of Civil Aviation about the noise caused by planes flying to and from Croydon.

A Ministry official replied: "There is very little we can do. Pilots gain height as quickly as possible, but the area around Croydon is all built up and the airplanes must pass over some houses." And that was that. Period.

How to Promote Public Use of Airports

Public relations, publicity program successful at Baltimore; Darrow advises Los Angeles.

A COMPREHENSIVE and continuing public relations and publicity program has been proved at Baltimore to be a successful way to attract the public to an airport. The idea has now spread to Los Angeles.

Such a program, as contrasted with past methods — weekend airshows, for example—is costly, but it pays off in the long run, according to Richard W. Darrow, public relations director of The Glenn L. Martin Co. and chairman of the public relations advisory committee of Baltimore City Airport Board.

Darrow's program of promoting increased use of Baltimore's $15 million Friendship Airport resulted in a recent invitation for him to advise Los Angeles aviation leaders on how to promote and publicize Los Angeles International Airport and a proposed airport bond issue.

"We delay the day when profits can be reckoned in the thousands of dollars by our failure to spend the hundreds of dollars necessary to properly acquaint the citizens of our communities with what airports, air travel, air shipping, etc., have to offer them," Darrow says.

Six Musts

From his experience as head of the original dedication day committee and the present public relations advisory committee in Baltimore, Darrow lists six "musts" for successful promotion of any publicly owned airport:

1. No city with a major investment of taxpayer funds in a sizeable air facility can hope to realize full economic return from such an investment without adequate promotional activity. It is not enough to depend on the airlines and fixed-base operators to carry the total promotion load.

2. It is questionable whether an adequate airport promotion program can be maintained permanently without the full-time attention of at least one capable public relations technician.

3. Cities can depend on civic-minded people and organizations to help plan and carry out an effective airport public relations program on a volunteer and gratis basis.

4. In most cities, results may come slowly; for this same reason, promotional activities must be consistent and unremitting before any considerable percentage of the non-flying people in the community will become air-minded and air-active.

5. Reasonable minimum budgets for full-time work and adequate promotional materials must be provided; otherwise cities will not gain what they should from the high-priced professional assistance they may receive from volunteer advertising, publicity and promotional practitioners.

6. Aviation still faces enough of a sales job to make public relations programs well worth the cost and effort. Dollars of expense now will be a vital factor in making thousands of dollars in profits possible years earlier.

During the six-months promotion campaign leading up to the dedication of Friendship Airport, the committee used a total of 45 different media. These included the conventional channels of local and national newspaper coverage, newsreels, radio, television and the trade press, plus many less obvious promotional tools, such as:

- Hotel lobby displays.
- Sidewalk stencils.
- Ballpark announcements.
- Postagemeter dies.
- Menu imprints.
- Soda fountain placards.
- Restaurant table "tents."
- Movie trailers.

Many of the promotions cost the city nothing; for example, the post offices in Baltimore, Annapolis and Frederick put messages concerning the new airport on millions of pieces of mail passing through their cancellation machines.

For others, the cost was relatively low, with the committee bearing the cost of printing car and window cards, windshield stickers and other promotional material, and various civic groups and private industries taking care of the distribution.

Result of this program was that over 175,000 people visited Friendship Airport on dedication day and the week of special days (Women's Day, CAA Day, etc.) which followed. Total cost to the city was about $44,000, including the services of a professional publicity firm to do the basic writing and leg work. Without the many voluhteer and gratis services, a comparable program might have cost as much as $200,000, it was estimated.

Baltimore was not willing to stop at that point, however. It apparently had provided facilities far greater than the city's existing air traffic and air shipping would justify, and there was an obvious need for a continuing promotional effort aimed at increasing patronage of the airport.

This conclusion led to formation of the Public Relations Advisory Committee as a permanent volunteer group to increase public use of the airport and public familiarity with its restaurant, observation pier and other attractions. Darrow has broken down the committee's program into three phases.

Present, Future Plans

1. Immediate implementation at minimum or no cost other than staff time.

(a) A frank discussion with local newspaper editors on the scope, aims and objectives of the committee.

(b) A brochure generally describing the facilities of the airport.

(c) Feature stories for newspapers, plant publications, magazines and other periodicals.

(d) Periodical digest of airport news with some degree of continuity.

(e) Field trips by school children and others.

(f) Educational forums at the airport.

(g) A schedule of organization meetings at the Airport.

(h) Guided tours of the airport administration building and facilities.

(i) Week-end sight-seeing trips.

(j) Cooperative projects with the airlines.

(k) Industry cooperation and endorsement of air travel.

(l) Special event radio and television programs originating at airport.

2. For implementation later with minimum budget.

(a) Leaflets and direction maps for distribution to hotels, travel agencies.

(b) Sponsored events—radio and television programs originating at the airport.

(c) Special television programs for school children.

(d) Purchased spot radio and television announcements using the slogans, "Fly from Friendship" or "Visit Friendship Airport."

(e) Additional arrangements for the appearance of suitable slogans or stickers in advertisements, on letterheads, envelopes, department store billings, payroll envelopes, etc.

(f) A series of window and lobby displays.

(g) Department store tie-ins.

3. For future implementation with adequate budget.

(a) Advertising in Maryland cities.

(b) Souvenir medal.

(c) Aviation editors' and writers' junket.

Airport News Digest

Airport Funds Cut: CAA's appropriation for fiscal 1952, as finally passed by the Congress: (1) Overrode the Senate proposal to make funds appropriated under the Act available until 1958 and adhered to the 1954 deadline favored by the House; (2) cut total airport funds for the fiscal year to $28,700,000, including $10,000,000 for liquidation of prior contract authority and $15,000,000 for projects in the states. Budget estimate had been $54 million. Results of the cuts probably will be to compel Office of Airports (1) to eliminate many small airports from the year's program, (2) cut back grants to some cities starting large administration buildings, and (3) resort to a cut in the percentages on which Federal participation is based. CAA hopes to get a little more money through a supplemental appropriation early next year.

Finnish Method: **Finland has worked out what appears to be an effective means of teaching drunken drivers a lesson, and at the same time keeping down construction costs on Helsinki's new international airport. When a Finn is caught driving an automobile while "under the influence," he is taken straight to the airport, given a sobering hot meal, and then put to work on one of the airport runways with a pick or shovel. The paper work in court is done later in the day.**

New CAA Program: CAA's Airport Maintenance and Operations Branch has been placed directly under Paul Morris, the chief of the Airport Operations Division, and has launched a new program which it hopes will be of real value to airport management. For one thing, a drive will be made to have the booklet, *Business Accounting for Airports,* adopted at all airports in Class 3 or larger categories. This booklet has been revised and approved by the Air Force and Navy as being satisfactory for their use in instances where they will enter into joint use of civil airports. CAA's first effort will be to obtain its installation at those locations where joint use with the military has been decided upon, and the campaign will then be aimed at airports where joint use with the military is anticipated. After that program is under way, attention will be directed toward installation of this particular type of accounting system at all Federal-aided, Class 3 or larger airports. Aviation directors of several states already have endorsed the system, and it is hoped it will be accepted on a nationwide basis.

RUNWAYS, OTHER PAVING

- **Work is about to begin** at Lambert-St. Louis Municipal on construction of a new runway, lengthening of another runway, and building of a new taxiway.
- **Paving of a 4,600-ft. runway** at Ashland (Ky.) Airport and of a 4,000-ft. runway at London (Ky.) Airport has been started.
- **Blacktop resurfacing** of the 4200-ft. NE/SW runway at Capital City Airport, Lansing, Mich., is under way.
- **New taxiways at Blue Grass Field,** Lexington, Ky., are now open for use.
- **Construction of a new taxiway** and a parking apron at Pittsfield (Mass.) Municipal has been approved.

LIGHTING

- **First known installation** of the Westinghouse Bi-Directional high intensity runway light (Type US) will be formally dedicated at Kansas City Municipal Air Terminal this month when main 7800-ft. runway will be opened for all-weather operation.
- **Lighting is being installed** on new 5460-ft. runway at Hillsgrove State Airport, Providence, R. I. Strip, opened to traffic last month, cost $1,200,000.
- **A new lighting system** is to be installed at Warren County Airport, Glens Falls, N. Y. at a cost of $40,000.
- **A $1,000,000 runway improvement program** involving relocation of three roads and extension of the E/W runway from 4,500 to 8,000 feet at Port Columbus, O., has been approved.
- **Resurfacing of the extension** of the 7,400-ft. instrument runway at Philadelphia International has been completed.
- **A new 4,000-ft. lighted asphalt runway** has been completed at Vail Field, Los Angeles, at a cost of $100,000.

KEITH SAUNDERS

Airport People

The Southeastern Airport Managers Association at its autumn meeting at Manteo, N. C., elected the following officers: **W. M. Shand, Jr.,** Columbia, S. C., president; **E. E. Bentley,** Jacksonville, Fla., vice president; **Marion Reid,** Charleston, S. C., secretary-treasurer. New members accepted into the association were: **William H. Lyons,** manager, Norfolk (Va.) Municipal Airport, and **Eugene C. Marlin,** manager, Patrick Henry Airport, Newport News, Va.

Forest G. Bowman, former civilian architect for the Air Force, is the new manager of Dayton (O.) Municipal, succeeding the late **Jack Connelly.**

Bob Goble recently took over as manager at Beatrice (Nebr.) Municipal.

Arthur E. (Art) Thomas, airport superintendent at Des Moines, was presented with a plaque in recognition of his more than 25 years of service to the city's airports and to the furtherance of aviation.

Ernest H. Thalman resigned as assistant manager at Tulsa Municipal to accept a position with an oil drilling firm.

New manager of Chehalis (Wash.) County-City Airport is **Ben Wells.**

William Latta is now manager of Hastings (Nebr.) Municipal, replacing L. V. Packard, who cancelled his contract with the city.

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Advertiser	Page
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Aircraft Radio Corp.	46
The B. G. Corp.	2nd Cover
Bendix Aviation Corp.	
Scintilla Magneto Div.	25
Products Div.	3rd Cover
Boeing Airplane Co.	27
Breeze Corps., Inc.	47
Cee-Bee Chemical Co., Inc.	53
Collins Radio Co.	44
Consolidated Vultee Aircraft Corp.	7
Fairchild Engine and Airplane Corp.	
Aircraft Div.	5
Stratos Div.	48
Flightex Fabrics, Inc.	58
General Electric Co.	12, 13
B. F. Goodrich Co.	14
Hertz Driv-Ur-Self System, Inc.	3
Hotel Lexington	46
Lockheed Aircraft Corp.	30, 31
National Airlines, Inc.	58
Reaction Motors, Inc.	29
Shell Oil Co.	8
Sperry Gyroscope Co., Division of Sperry Corp.	32, 33
Surface Combustion Corp.	9
The Texas Co.	Back Cover
Transport Equipment Co.	55
United Air Lines, Inc.	52

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KAMAN AIRCRAFT CORPORATION
Windsor Locks, Conn.

The Washington View

By Vera Foster

NOW that the bulk of the work on the Reserve bill is out of the way, Congressional spokesmen promise that the bill on ROTC airman training is next in line for consideration. It's too late for hearings to start in this session, but early in the next one look for hearings to begin.

Training contracts available to local operators near ROTC colleges will not be as large as some surmise. Air Force officials estimate that, in line with present numbers of ROTC students assigned to pilot training, operators will have fewer than a half-dozen students. Should Air Force requirements for pilots expand, however, an increase in business should result.

•

Lightplane manufacturers are eyeing the realignment of military plane production schedules, wondering if the DPA metals allotments reductions will mean a cutback on allocations for commercial airliners and lightplanes. Observers believe that, in line with DPA recommendations, allotments for military plane parts will be curtailed first.

•

The Hawthorne School of Aeronautics is conducting a survey of higher learning institutions in the U. S. to determine what credit Air Force cadets would be allowed for their Air Force training.

"Many of the young men we have in training here," Hawthorne representatives assert, "had to interrupt their college training in order to enter . . . The fact that they interrupted their academic training has caused them considerable alarm and they are concerned about what credit they might expect from the various schools when they return to get their degrees."

Universities and colleges have heretofore delegated flight training to a relatively low position in academic training. The trend that keeps cropping up more and more frequently today, however, is to re-evaluate flight training when carried on as a controlled course; that is, under college supervision or in accordance with a military curriculum.

•

While our aviation gas taxes are being increased here in the United States we note that a lucky neighbor in South America, Bolivia, now enjoys aviation gasoline with no sales tax at all.

•

The delegation option procedures for certification of lightplanes (amendment to Part 410 of the Civil Air Regulations) will become effective December 4th.

This delegation of authority is the result of a long-standing plea from lightplane manufacturers, who, engaged in their continual battle between aircraft weight, strength, performance and cost, want to run their own certification tests. In the past, CAA was able to ask that many tests be re-run in order to satisfy the government that new-type planes met current airworthiness and strength criteria.

Manufacturers qualified to operate under the delegation option must maintain staffs of engineers to insure good design practices. Those planemakers who are eligible and choose to take the opportunity to assume more responsibility may now design, test, produce and sell an aircraft without any CAA scrutiny.

Both Cessna and Piper aircraft companies are reported to be interested in the delegation inspection option.

•

Philadelphia's oldest landing field, Boulevard Airport, has been closed to make room for a housing development. We hear that houses are also occupying the airport that was previously the Miami Aviation Center, and that the east-west runway is now a street! It pays to fly with your Airman's Guide, nowadays—lest you land in a field that's been planted in potatoes, or maybe subdivided!

•

Flex-O-Props can be purchased now at $89.00 list for the most standard makes of light aircraft. These props, which flex in flight, give improved climb and cruise performance, according to their manufacturers the Munk Aeronautical Laboratories, Brentwood, Md.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

AMERICAN AVIATION published weekly at Harrisburg, Pennsylvania for October 1, 1951.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Wayne W. Parrish, Washington, D. C.; Editor, Wayne W. Parrish, Washington, D. C.; Managing Editor, Eric Bramley, Washington, D. C.; Business Manager, Leonard Eiserer, Washington, D. C.

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3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

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5. The average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the 12 months precedinug the date shown above was: 11,372.

LEONARD EISERER,
(Signature of business manager)

Sworn to and subscribed before me this 1st day of October, 1951.

J. RUSSELL SHEFFER,
Notary Public,
(My commission expires March 9, 1955)

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Letters

(*Continued from page 10*)

with his mother and father—and to his job with TWA.

GEORGE L. HAITHCOCK
TWA, Washington, D. C.

Re Statistics

To the Editor:

This letter is rather hard to write. I have a complaint to make, and since this is the first time that I have ever found fault with AMERICAN AVIATION, I don't know how to go about it.

For some time now, you have been comparing the airline statistics and financial statements by halves and quarters of this year to those of last year. I think that the old way of reporting traffic and financial statistics month by month is much, much better. As an airline stockholder, I am in favor of the month by month reports.

If any of the subscribers wishes to compare this year with last. he can get his last year's copies out. If he throws away a copy of AMERICAN AVIATION, he should be shot.

JACK HOULEHAN
Kansas City, Mo.

(Present method of presenting statistical tables gives readers a comparison not only with other carriers but also with last year. We have found that most readers prefer this method—Ed.)

They Were Test Runs

To the Editor:

Ref: Your Newsletter Volume 15, No. 18 of October 1, 1951 issue.

Under the 'Planes and Equipment' section, there appeared some data on the new Boeing 'jet-type' spark plug for piston engines. A comparison was made along the lines of maximum service life with standard spark plugs.

It is known that existing types of piston engine spark plugs have run over 400 hours in the Pratt & Whitney R2800 engine used in commercial service. The comment that the Boeing plug ran 70 hours against 22 hours for standard plugs need qualifying. Perhaps there were some special conditions of operation used in obtaining these results.

I believe the article should be reprinted in a manner explaining the circumstances surrounding the mentioned test runs; since no commercial operator could even consider using a spark plug with an expected service life of 22 hours, or even 70 hours.

J. E. BERGER
Garden City, L. I., N. Y.

(Conditions referred to in article were abnormal conditions used for plug fouling tests and not representative of normal service use. In some eight pages of coverage on spark plug and ignition developments elsewhere in this issue, reader Berger's point is dealt with in some detail. It might be noted in that story that in Shell Oil Company's test of a new fuel additive, which is supposed to reduce spark plug fouling, laboratory tests showed a normal plug to last less than five hours under test conditions.—Ed.)

BOEDY'S ALBUM

H. W. "Herb" Rubottom
NY University
at Paterson, N. J.
November 13, 1939

Ralph W. Beecher
Pan American Airways
at Paterson, N. J.
November 16, 1939

Paul deKuzmik
Pan American Airways
at Paterson, N. J.
November 16, 1939

Charles F. "Billy" Keale (QB)
City of New York Park Dept.
at QB Meeting, New York
November 20, 1939

H. C. "Herb" Smyth, Jr. (QB)
at QB Meeting, New York
Murray Hill Hotel
November 20, 1939

R. A. "Dick" Magee (QB)
Truro, Mass. Fire Dept.
at NY QB Meeting
November 20, 1939

J. H. "Joe" O'Neil (QB)
O'Neil-Brennan Inc.
at NY QB Meeting
November 20, 1939

T. W. "Tom" Rutledge
Wright Aeronautical Corp.
at NY QB Meeting
November 20, 1939

Shiao Dawn Chiang
Chinese Air Corps
at Paterson, N. J.
November 21, 1939

J. B. "Jim" Underwood (QB)
White Aircraft Corp.
at Paterson, N. J.
November 21, 1939

Edgar W. Percival
Percival Aircraft Ltd.
at Paterson, N J.
November 21, 1939

Amherst Villiers
Percival Aircraft Ltd.
at Paterson, N. J.
November 21, 1939

R. T. "Dick" Crane (QB)
Airline Feeder Systems
New York City
November 22, 1939

S. B. "San" Kauffman
Pan American Airways
New York City
November 22, 1939

R. A. "Ray" Miller
American Airlines
at Paterson, N. J.
November 24, 1939

Bruce G. Leighton (EB-QB)
Inter-Continent Aviation
at WAC-Paterson, N. J.
November 28, 1939

Candid snapshots from the famous collection of Kenneth

BOEDY'S ALBUM

Leo A. Kieran
New York Times
at North Beach, N. Y.
November 28, 1939

C. F. "Buck" Weaver
American Airlines
North Beach Airport
November 28, 1939

J. B. "Jack" Armstrong
Eastern Air Lines, Inc.
at North Beach Airport
November 28, 1939

John H. Darragh, Jr.
Wright Aeronautical
Paterson, N. J.
November 29, 1939

E. Kenneth Reese
The Foote-Burt Co.
at Paterson, N. J.
November 29, 1939

J. N. "Colonel" Gentry
Pan American Airways
at Paterson, N. J.
November 30, 1939

Horace Brock
Pan American Airways
at Patbrson, N. J.
November 30, 1939

M. C. "Andy" Anderson
Pan American Airways
at Paterson, N. J.
November 30, 1939

Ralph H. McOuat
Pesco Pumps
at Paterson, N. J
December 1, 1939

Kermit J. Leach
Naval Aircraft Factory
Philadelphia, Penna.
December 2, 1939

Bertha (Mrs. K. J.) Leach
at Army-Navy Game
Philadelphia, Penna.
December 2, 1939

E. W. "Dyke" Dichman
Vought-Sikorsky Aircraft
Bridgeport, Conn.
December 4, 1939

Frank A. Coriell
Vought-Sikorsky Aircraft
Bridgeport, Conn.
December 4, 1939

F. F. "Fred" Bottiger
Vought-Sikorsky Aircraft
Bridgeport, Conn.
December 4, 1939

E. "Ernie" Wenigmann
Vought-Sikorsky Aircraft
Bridgeport, Conn.
December 4, 1939

Michael E. Gluhareff
Vought-Sikorsky Aircraft
Bridgeport, Conn.
December 4, 1939

Candid snapshots from the famous collection of Kenneth

IN FLIGHT

A PAGE FOR ALL PILOTS

Global Nonstop — in One Day

A NUCLEAR-POWERED airplane could circumnavigate the globe at local midnight, accomplishing the entire flight in darkness, according to Dr. M. C. Leverett of the General Electric aircraft nuclear propulsion project under which a plant-laboratory for production of a nuclear plane is being built at Lockland, Ohio. The flight described by Leverett would require a speed in the neighborhood of 1,000 miles per hour.

Leverett said that one pound of uranium-235 such as the project plane will use for fuel will liberate heat equivalent to energy liberated by burning 1,700,000 pounds of gasoline. Fuel consumption would be measured not in pounds per hour but pounds per day.

Because it could stay aloft for days, a nuclear plane, said Leverett, could fly at its maximum speed and at any altitude for all of its mission and still have plenty of fuel for the return trip home by any route.

Basic principle in building a nuclear plane is that energy liberated by fission of nuclear materials is manifested as heat, which must be converted into thrust. Propellers rotated by turbines which are run by expanding steam have been proposed as propulsion unit, while ram-jets and turbojets have also been considered.

Heavy shield which must surround the reactor in which heat is generated will probably weigh from 50 to 100 tons, Leverett said. This means that the nuclear plane must be a big one—comparable in weight to modern heavy bombers which carry around 75 tons of fuel on long flights.

But concentration of the heavy reactor and its shield in a single spot in the plane gives rise to aerodynamic problems. Fuel, usually the heaviest single weight in present-day large planes, is distributed over the wing and throughout the fuselage. Leverett points out that concentration of the reactor weight in the fuselage greatly increases wing bending moments and necessitates structural redesign. But, in spite of these problems, Leverett predicts that efforts to fly an airplane on nuclear power will be successful.

Pilot vs. Electron Tube

FICTION writers and even serious scientists for the past several years have been amusing themselves—and possibly their readers—with their comparisons between the new and complicated electronic computing machines and the human brain. These machines, we are told, can have nervous breakdowns, sometimes take time to "think up" answers, and in general act alarmingly like a perplexed human thinker.

The tables have been turned by Lt. Col. Walter F. Grether, psychologist at the Wright-Patterson AFB Aero Medical Laboratory. He has compared an average pilot's efficiency with that of a sensitive servo mechanism or computing machine. He finds that there is a good deal to be said for the human-type brain, but he writes that a man cannot "match a properly functioning servo system in rapidity of action and freedom from unpredictable errors."

He regards a pilot as an extremely complex servo or boost. A diversity of information can be "fed into" a walking, talking machine through the eyes, ears, and other sense organs, just as potentials and pressures are run through a sub-human think box. The human machine also has a variety of output actions. It can operate control levers, knobs, switches, guns, bombsights, and can far exceed even the best of the electronic computers in its ability to make a coherent entry into a navigation log or to respond to a spoken instruction.

Real excellence of the human machine, Col. Grether writes, is its ability to store up incoming data for the control of future action and to exercise critical judgment. He says the ability of the man-machine to handle critical and diverse data could be matched only by construction of a prohibitively complex servo system or automatic computer.

All things considered, Col. Grether seems to think a pilot is a pretty good machine, but he says his performance can be further improved by making instruments (through which data is "fed in") easier for the pilot to read. He's working on that now.

And All He Got Was a Headache

MAJ. J. P. Stapp, flight surgeon at the Wright Air Development Center, in recent deceleration tests accomplished the equivalent of landing an airplane at a speed of 120 miles per hour and then stopping it in 19 feet in less than one-fourth of a second. In the tests he was subject to linear deceleration of 46.6 g. Previous record was 38.4 g. His new record shows that the human body can withstand higher forces than had ever been thought possible.

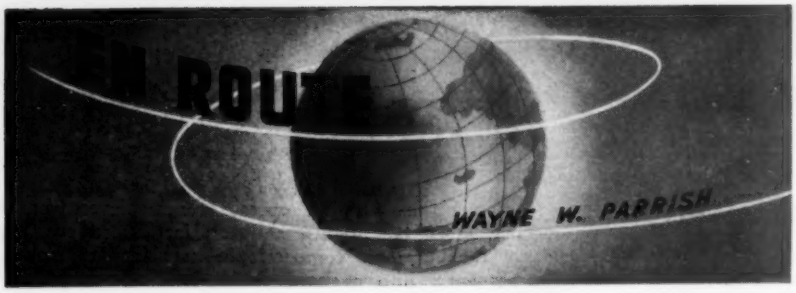
The device in which Maj. Stapp slowed down fast was a sled mounted on rails and propelled by three 1,000-pound rockets. From a dead stop, the sled whipped up to a speed of 170 miles per hour in the space of 500 feet. After coasting, it entered the braking system at a speed of 154.8 miles an hour. Then in 31.2 feet, the sled slowed down to 34.4 miles an hour, giving Maj. Stapp a headache which lasted for several hours.

But in spite of this, he reports that he never lost control of his faculties and did not experience any of the symptoms of blacking out. Only injury was a minor one. He suffered small hemorrhages of the small veins in his eyeballs.

Facing in the direction of the propulsion, Maj. Stapp, who went through his ordeal bareheaded, was protected by a wind screen and was held in place by a nylon webbing harness consisting of shoulder straps, lap belt, and inverted-V leg straps.

Desk Jockey Flight Pay Unchanged

AN erroneous report in a trade magazine caused some confusion in military circles as to Congress' final decision regarding flight pay for Air Force and Navy desk officers, but the decision was that administrative officers will continue to draw flight pay on the same basis as previously. The Senate-House conference on the 1952 appropriations bill ruled out the Senate-passed 20 hour per month requirement and specifically included flight pay for proficiency flying of administrative personnel. The annual requirements for maintenance of flying status remain the same as before—100 hours, of which 20 hours must be instrument time and 15 hours night time, including a minimum of 35 hours in either half of the year, although flight pay may be drawn upon completion of four hours in any given month.



Bloody Noses. So you want to see some bloody noses, a guy knocked out by a knee blow to the chin, and some guys kicking each other in the face? No, not on TV. This is even crazier than TV. Let's go to a Sunday afternoon boxing match in **Bangkok.**

When **Ed Lind** of PAA said we mustn't miss Siamese boxing he warned my wife that it was on the rough side. She allowed as how she could take it. The three of us arrived at the small stadium at 5 o'clock in the afternoon and Lind procured three front row seats. The audience was composed of about 3,000 Siamese, mostly men, and perhaps a dozen westerners.

The sun was still shining, the temperature was fairly high but not too uncomfortable and the Coca Cola guy was making the rounds. The only thing missing was popcorn.

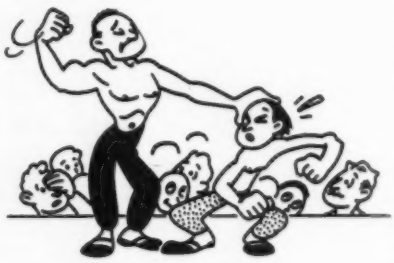
✣ ✣ ✣

Boxing to Music. The Siamese outdo TV boxing. They have an orchestra—if you can call a flute, a tom-tom and a pair of cymbals an orchestra. As each match starts the rhythm is slow but keeps increasing in tempo until the final round when it's going to town with as much vigor as you can get out of a flute, tom-tom and cymbals. Just think of snake charming music and you've got the pitch.

There were six events and the fifth was listed as a featherweight championship, but that doesn't seem to mean much in Siam. They have championship bouts every week. The Siamese are

all featherweights, light, wiry and brown-skinned.

Another thing that TV won't give you: as the boys come into the ring before each match the music starts playing and the boys start praying. Each kneels in the direction of the house of his teacher. After a half-minute of prayer each boy gets up and demonstrates to the audience just how he's



going to knock out his opponent. It's something like a Javanese dance. Each one acts plenty tough—in advance.

✣ ✣ ✣

Free-For-All. Once the praying and demonstrating are over, the bell rings and off they go. Everything flies at once—knees, legs and arms. No holds barred. Nothing is illegal in Siamese boxing. The more you can kick the other guy in the face the better the audience likes it. Kneeing is a prized specialty. They do everything except box.

The mimeographed program was in English and it said the first event was 124 lb. Kim Weng versus 130 lb. Poe Loogthon. Weng, the program said, "possesses terrible sensational left, clean-cut kick; supporting with the lion-hearted character." Loogthon "contains the nimble actions of elbow, punch and kick; supporting ruthless character."

The first event lasted short of two rounds. Brother Weng's lion-hearted character didn't do him much good. Loogthon knocked him clean out by a series of kicks to the face, knee actions and some sharp elbowing.

Sometime a Siamese boxer may try boxing and surprise everybody.

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Out Cold. After the second event I lost faith in the program. It had said a bird by the name of Chumpol "possesses terrible punch, hurtful elbow and dangerous kick which supported by violent action in using dangerous knee to land opponents in the solar plexus or on chins." But in the second round when poor old Chumpol led with a terrific kick to the face of his opponent by name of Dhevin, Dhevin dodged slightly and came in with a smashing punch that knocked our old Chumpol for a loop and then some. He was out cold.

Round 3 went even faster. One guy landed a knee to the chin of the other guy mid-way in the first round, and that ended that little encounter. I was beginning to feel short-changed. The stretcher-carriers were doing more work than the boxers.

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They Just Laugh. The championship bout was the bloodiest I've ever seen, and I was lucky not to get some sprayed on me in the first row. It went all five rounds but for three rounds a guy by the name of Vihock had so much blood on his face I couldn't figure out how he could see what he was doing. He had a fine technique for kicking the other guy's face, but he always left himself wide open for knee punches. Give him credit, though, he lasted out five rounds.

The crowd is polite. The Siamese never boo as sports crowds do in the U. S. They just laugh like hell and I think it's more effective.

Each boxer has a small statue of Buddha wrapped in a small cloth strip around one arm. The Buddha is supposed to keep the guy from getting hurt but after seeing four guys carried off the mat I would have a little reluctance in placing so much faith in Buddha myself. That's the trouble with mixing religion with boxing. Both guys place the same reliance on the statue. Somebody's got to lose. So where are you?

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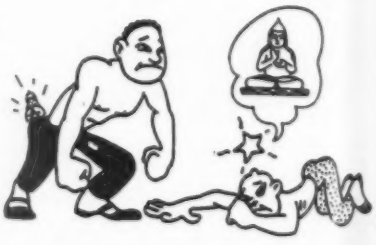
Once is Enough. One more thing about this crazy so-called sport over there. The time out between rounds is two minutes instead of the one minute



observed over here. All I can say is that they sure need it. Call it boxing if they will, but it's just a free-for-all. It's fun to watch. Well once, anyway.

After all, there isn't an awful lot to do in Bangkok. There is one, just one, American-type air-conditioned combination cafe-bar-nightclub, opened up in the past couple of years with American food and as clean as you can get it in Bangkok. It's a hangout for Americans. There is a big colony of Americans (connected with the Embassy and with the trillion government agencies which you taxpayers provide) and the colony has its own social life. Otherwise, apart from sightseeing, there ain't much to do at night. Bangkok isn't Paris.

wings, canopy, landing gear and tail. Previously engines were checked in the finished airframe and had to be removed for adjustments.

Vibration testing tower to simulate aircraft and missile flight path vibrations and physical vibrations and oscillation experienced by supersonic planes has been constructed by Bell Aircraft Corp. The unit is capable of vibrating 3,000 pound parts at frequencies between 1 and 15 cycles per second with amplitudes up to five feet.

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AIRLINES

Order for seven DC-6A Liftmaster cargo airplanes was placed by The Flying Tiger Line with Douglas Aircraft Co. Total cost will be $7 million, with deliveries scheduled for mid-1953.

Rumors that he was disposing of his interests in All American Airways were emphatically denied by Robert M. Love, AAA president. He said he had recently reduced his stockholdings from 78,845 to about 55,000 to take care of a personal obligation, but does not plan to sell any more and will remain the largest single AAA stockholder.

Favorable verdict was handed down by a federal jury in Hawaii for Hawaiian Airlines and Inter-Island Steam Navigation Co., co-defendants in an anti-trust suit brought against them by Trans-Pacific Airlines. TPA had claimed that defendants had conspired to restrain trade and commerce in transportation field in Hawaiian Islands over a period of years.

Air Line Pilots Association signed new contracts with Chicago and Southern, Continental and Wisconsin Central and aims to negotiate new agreements with majority of domestic trunklines before year-end. Signed in recent weeks were pacts with Eastern, TWA, Capital and Robinson, and several others are in negotiation.

Thomas K. Taylor, former assistant to the board chairman and assistant vice-president of TWA, has been elected a vice-president of the company, with headquarters in Washington. Clarence E. Fleming has resigned as a TWA vice-president but will serve the company as a consultant, based in California.

Separation of subsidy from mail pay doesn't mean that domestic mail payments will be "ruthlessly reduced," CAB Chairman Donald Nyrop told Wings Club in New York. Separation means "only that the Board, Congress, the airline industry and the public will know for the first time how much it costs to operate airlines for carrying the mail and how much in subsidy to provide additional development costs." He predicted that many other airlines will join Big Four in non-subsidy category in the future.

Airlines' committee told Chicago city officials that while it may be necessary for carriers to retain some scheduled operations at Midway Airport indefinitely, they intend to move major portion of flights to new O'Hare International Airport provided adequate landing field and terminal building facilities are completed, highway facilities are constructed, and satisfactory contracts can be worked out. City sought airline views before deciding whether to okay proposed $15 millon revenue bond issue to complete final Stage One development of O'Hare.

Office of Aviation Defense Requirements, CAA, authorized TWA to proceed with construction of $2,660,000 hangar at Midway Airport, Chicago. United Air Lines was authorized to improve San Francisco maintenance base facilities at cost of $1,100,000.

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CIVIL AERONAUTICS BOARD

In precedent-setting decision on Chicago and Southern's mail rates, CAB ruled that it won't use earnings of domestic operations to offset losses in carrier's international services. It also emphasized that "fair and reasonable" investment returns of airlines will be protected against federal tax increases by providing tax allowances in mail rate computations equal to actual tax liability. Post Office had urged offset, and had been against tax allowance. CAB set final mail pay of $3,662,000 for C&S international operation for period Nov. 1, 1946 to Dec. 15, 1950.

A 75% cut in Pan American-Grace Airways' temporary mail pay, to prevent excessive overpayment pending establishment of final rates, has been proposed by CAB. Retroactive to Oct 1, 1951, and in line with new policy under which temporary pay is designed to meet only estimated break-even need for future, proposal would reduce Panagra's annual pay from $2,603,000 to about $623,000.

Northwest Airlines asked CAB for permanent or temporary renewal of trans-Pacific certificates. Permit for Alaska and Orient expires Dec. 13, 1953; U. S.-Honolulu, July 29, 1953.

CAB fixed National Airlines' temporary mail rate at 53c per ton-mile, retroactive to July 1, 1951. NAL had been receiving about $2. New rate is designed as a temporary subsidy-free measure to remain effective until final rates are set.

CAB stayed its order revoking Air Transport Associates' non-scheduled airline letter of registration pending action on petition for reconsideration. Stay and reconsideration had been asked by Amos Heacock, president of the company, who claims CAB's order is "unconstitutional and illegal."

Trans-polar route from Fairbanks, Alaska, to Europe, for operation with jet transports, has been asked by Alaska Airlines in CAB application. Flights couldn't be made before 1956, and application is part of long-range plan, company spokesmen said. Route would be from Fairbanks to co-terminals of London and Paris via Oslo, Norway.

Delta Air Lines opposes requests of six airlines for expanding New England-Southern States Merger Investigation. Delta, which has voluntary merger proposal with Northeast before CAB, said case could grow to "unmanageable proportions."

CIVIL

Airport construction projects now underway will be kept going through the winter as a result of structural steel allotments to CAA for the first quarter of 1952. CAA received 17,077 tons of steel, 735,000 lbs. of copper and 100,000 lbs. of aluminum for 1952's first three months, including 5,400 tons of structural steel as against 1,000 tons for 1951's fourth quarter. CAA's Office of Airports expects to be able to approve construction of a few additional Priority 1 and 2 airport building projects as a result of the DPA grant.

James J. Strebig, Associated Press aviation editor died of cancer Oct. 19 at his home in Washington, D. C. He was buried at Fort Wayne, Ind.

Eight large South Carolina cities have formed the South Carolina Chamber of Commerce Aviation Association and have invited 15 other cities to take part. The group will promote flight safety programs, aviation education, airmarking and airports.

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FINANCIAL

Manufacturers

Douglas Aircraft Co. netted $5,249,513, or $4.37 a share, on sales of $153,000,000 for the nine months ended Aug. 31 compared with a net of $4,748,230, or $3.96 a share, on sales of $95,000,000 for the same period of 1950. Backlog is now $1,335,000,000.

Lockheed Aircraft Corp. has filed a registration statement with SEC covering 46,370 shares of $1 par capital stock for officers and employes. It is expected to raise $735,520 for general corporate purposes.

Aeroquip Corp. will pay a 5c dividend on its common stock Nov. 15 to stockholders of record Nov. 1.

Airlines

Capital Airlines netted $1,225,171, or $1.57 a share for 1951's first eight months compared with a net of $766,921 or $1.50 a share for the same period of 1950. Net for the year is expected to exceed $2.27 a share compared with $2.02 last year.

Delta Air Lines will net about $385,000, or 77c a share, for 1951's third quarter, compared with $190,000, or 44c a share, for the same period last year. A 25c dividend will be paid Dec. 20 to stockholders of record Dec. 5.

American Airlines will pay a 25c dividend Dec. 14 to $1 par common stockholders of record Dec. 3. It will also pay $.875 a share on Dec. 1 to holders of its $3.50 cumulative preferred stock on record Nov. 15.

Northwest Airlines had an estimated $400,000 net in September, bringing nine month earnings to better than $1 share.

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LABOR

Douglas and IAM have agreed on a 5% wage boost plus a cost of living escalator clause for employes at El Segundo and Santa Monica. Contract also includes automatic progression provisions and provides for a study of 20 key jobs.

Solar Aircraft Co. and the IAM-AFL have agreed on a new contract covering 1,500 Des Moines, Iowa, workers. Pact calls for a 10¢ pay boost, automatic nickel raises either monthly or at four-month intervals, depending on job classifications and other benefits. Hikes are retroactive to Sept. 1 and must be approved by WSB.

McDonnell and International Brotherhood of Electrical Workers-AFL representatives have signed a 40-month agreement providing for a 10-cent boost Nov. 5 and four-cent "improvement factor" hikes in November, 1952, 1953 and 1954. Added 11-cent cost of living allowance also becomes effective Nov. 5.

Production and maintenance workers at Bridgeport-Lycoming Division, Avco Manufacturing Corp., Stratford, Conn., will vote in an NLRB election Nov. 20 to choose between IAM and UAW as a bargaining agent.

Convair-Fort Worth and IAM representatives have started negotiations on a new pact covering 22,000 workers. Present contract ends Nov. 21.

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AROUND THE WORLD

Swissair and Compania Mexicana de Aviacion have each ordered three DC-6B's from Douglas Aircraft Co. for 1954 delivery. Each airline now owns three of the B's.

Nine nations attending a Paris meeting on air traffic control are agreed that Europe must have a coordinated airways system and must set it up soon. A meeting next February in Paris, sponsored by ICAO, will take up specific provisions based on these principles.

RCAF has ordered an undisclosed number of Mark 31 Bristol Freighters powered by new Hercules 734 engines. First delivery was scheduled for October.

U. S. has agreed to pay Britain's Power Jets Research and Development Ltd. $4,000,000 in full settlement of claims for American use of British gas turbine patents. Original claim was for $10,000,000 but was reduced in view of payment made by U. S. engine builders for licensing rights.

BOAC service from London to Rome and Cairo with de Havilland Comets has been postponed till late March or April. First complete production Comet will be delivered to BOAC this month with a second scheduled for December delivery.

Fokker plant in Amsterdam is designing a twin-engine turboprop transport and will build a prototype if Dutch government approves the design. KLM and Dutch Institute for Aircraft Development are reported ready to finance development of such a plane.

Commonwealth Aircraft Corp., Melbourne, has placed substantial orders with North American Aviation for components, jigs and tools to produce an Avon-powered F-86E in Australia. Sabres will start being assembled there by year's end.

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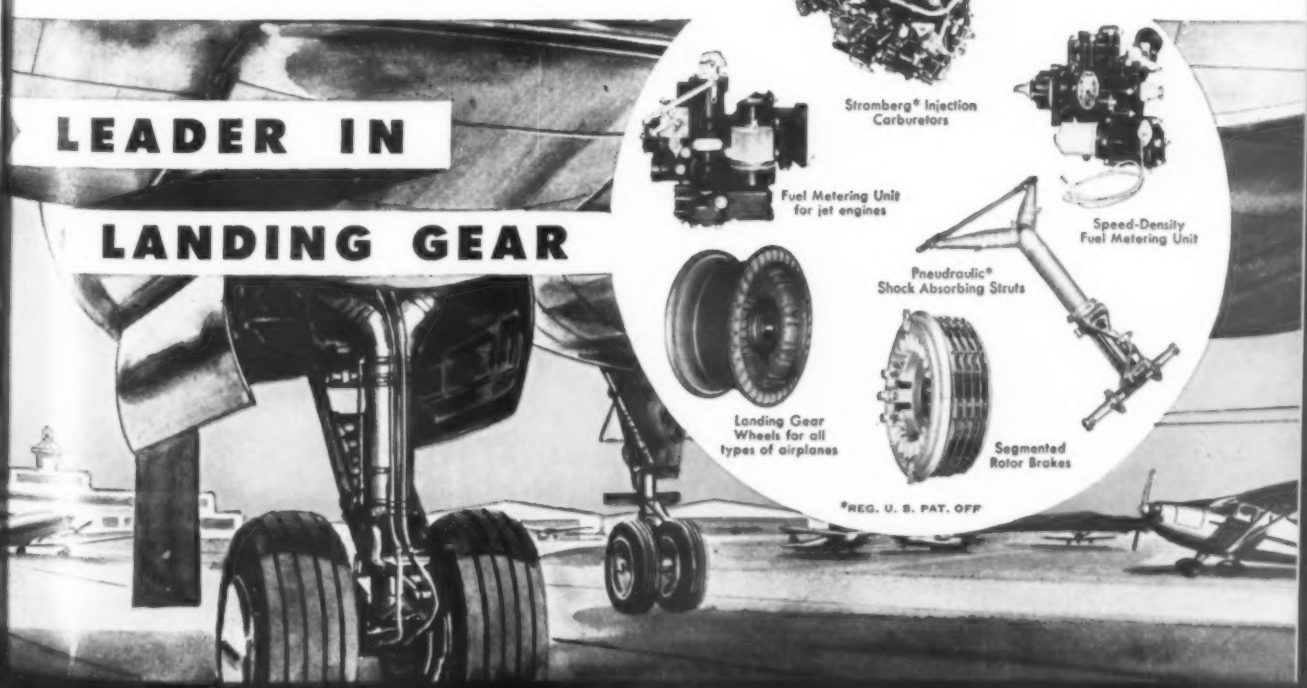
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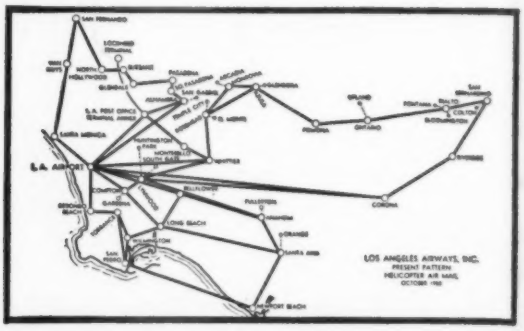

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American Aviation

NEWSLETTER

Entered as Second Class Matter November 5, 1951 Vol. 15 No.

RECEIVED 5 NOV 1951 ARMY LIBRARY SERIAL RECORD

Denying published reports, the Air Force says Korean plane losses have not forced curtailment of operations elsewhere, although it admitted operations were temporarily cut in Europe because of a jet engine shortage. The engine shortage came about through a shipping mixup rather than unavailability.

USAF had "no comment" on another report that Korean losses are outstripping deliveries. Although this is normally a confirmation, in this case it merely means the USAF does not want to release delivery figures and overall attrition rate.

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Despite USAF's crackdowns on acceptances of gratuities from manufacturers, Under Secretary Roswell L. Gilpatric says the rulings do not affect such things as attendance at regular public functions as guests.

He indicates, however, that there are no USAF plans to change its AMC directive, which prohibits acceptance of "money, entertainment, gifts, hotel accommodations or other special favors."

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New director of the Aircraft Production Resources Agency at Dayton, Col. Kern D. Metzger, is expected to work very closely with aircraft and engine manufacturers in eliminating shortages of critical materials and equipment and allocating materials.

Metzger, a reserve officer who served with the World War II Aircraft Scheduling Unit at Wright Field, has the backing of Aircraft Production Board officials in Washington. He steps into a job in which his predecessor, Col. George E. Schaetzel, was often at cross purposes with Brig. Gen. Alfred H. Johnson, former chief of the Industrial Resources Division of AMC's Directorate of Procurement and Production.

Johnson is now slated for a Pentagon assignment and Schaetzel has been transferred to the Procurement Directorate, with Metzger taking over both jobs. Informed sources expect him to be nominated for his first star so that he will have the power to enforce his decisions.

Other APRA representatives, Capt. Roy Jackson of the Navy and Col. Richard R. Danek of the Army, remain in their posts.

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USAF has started its heavy press program to produce the aluminum forgings and extrusions needed by aircraft manufacturers. Plans call for the installation of 20 presses in a number of plants across the country. The program is expected to cost $210,000,000 over the next four years.

Presently installed equipment includes an 18,000 ton capacity press but the new program calls for even bigger ones. Discussions have even been held on the feasibility of building a 75,000 ton forging press.

Among the firms now scheduled to receive the USAF presses when they become available are Wyman-Gordon, Aluminum Company of America Reynolds Metals, Curtiss-Wright, Harvey Machine Co., Kaiser Aluminum and Chemical Co. and Bohn Aluminum and Brass Co.

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DPA, which approved tax certificates for $25.4 million in aircraft plants, $252.4 million in engine and engine parts plants and $37.6 million in plants to produce plane parts and accessories as of June 30, estimates that 56, 40 and 46%, respectively, were in place Sept. 30.

On that date, $14.1 million in plane factories, $101.1 million in engine and parts facilities and $17.4 million in parts and accessories plants were scheduled for completion.

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Many producers of military aircraft parts who are having difficulty placing their approved authorizations for CMP materials have started a campaign to be placed on a special NPA "B" products list. At present they find themselves with no special priority to obtain steel, copper and aluminum at the mills.

Munitions Board and other government aircraft production officials feel that the situation will be straightened out in a few months as a result of expansion and planned enforcement programs. However, they admit it may be necessary for a limited time, to establish a special list like the one proposed by plane parts makers.

Biggest Obstacle to such an authorization is the fact that every firm will clamor to be included on the select list, making it virtually worthless. If such a program is started, it will be limited to firms that have at least 75% of their production going to the military.

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A national plan for airline routes, on which CAB has been working informally for some time, has been supplanted by regional plans. CAB figured a national plan was too much to digest at one time and is now proceeding within smaller limits through the medium of merger investigation orders. It will move a few steps at a time and will not issue new orders until present ones (like Continental-Mid-Continent merger) have been moved forward with action. Several other [illegible] being considered by Board members, however.

CIRCULATION COPY 3

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Agreement on air routes between U. S. and Mexico, stymied for some years, seems to be moving

toward conclusion, under high-level pressures from both governments. Present outlook is for substantial revision of original U. S. certificates, and CAB has been active in trying to reach informal agreement among the carriers. In one instance, at least, an interchange will be substituted, and a new deal for the western end is in the cards.

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MANUFACTURING

USAF says cancellation of Lockheed's contract to produce the F-94D long-range tactical jet fighter for ground support work is a "routine readjustment of production schedules." Firm's contracts for F-94B and C all-weather interceptors are not affected.

A new six-member Committee on Tax Amortization and Negotiated Contracts has started work to determine what part of tax amortization may be allowed as a cost in renegotiating government contracts. Section 103-A of the Renegotiation Act provides that items allowed as deductions for tax write-off purposes shall also be allowed as costs when renegotiating contracts.

NPA has ruled that aircraft quality alloy steels are to be used only for aircraft, guided missiles and in connection with the atomic energy program.

Aircraft workers increased from 199,000 to 343,000 in the 12 months ending in July, according to the Labor Department, which added average weekly hours in that period went from 42.4 to 43.7. Average weekly earnings increased from $68.94 to $77.74 while hourly earnings jumped from $1.626 to $1.779.

NPA-DPA have set up a four-man security committee to determine what the public may be told about defense production. It will be headed by DPA deputy administrator James F. King, a former Baltimore and Washington newspaperman.

The Glenn L. Martin Co., which now has more than 2,000 workers in the government-owned Plant 2, expects to start using all of the plant's 1,449,375 square feet early next summer.

Bingham-Herbrand Corp. will receive more than $5 million in USAF equipment, including 18 forging presses, for its Fremont, Ohio, plant to make forged buckets and blades for the Studebaker version of the General Electric J-47.

Contract for 1,000 three hundred gallon wing tanks has been received by Marine Aircraft Corp., which is waiting word from the USAF before starting its $2,000,000 Eagle Mountain Lake, Tex., plant. Marine also has a contract to fit Grumman SA-16A's to take radio-controlled eight-man crash boats.

A Federal grand jury in Dayton has indicated a Cincinnati industrialist and a former AMC electronics buyer on charges of giving and accepting bribes and conspiring to commit fraud. Named were Luther M. Kratz, the former USAF buyer, and Lawrence A. Rozete, head of Cincinnati Electronics Corp. and Raytronics Laboratories, Inc.

John T. Mascuch, Breeze Corps. president, 52, died at the Johns Hopkins Medical Center after a brief illness.

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PLANES AND EQUIPMENT

Douglas proposal to equip some of its DC-6B's with advanced Wright R-3350 engines instead of Pratt & Whitney R-2800's has drawn the interest of American Airlines and Pan American World Airways. The new Wright engine would have 2,800 hp and would be designed to cruise at 23,000 feet. It would also be available sooner than the R-2800.

Two new versions of the Sabre, the F-86F and the F-86H, have been ordered into production by the USAF. Both North American planes will feature improved General Electric J-47 engines and the H will be slightly larger than current models.

Fairchild Engine Division has started producing the 1,000-pound thrust J-44 jet engine, which weighs about 325 pounds, is six feet long and about 22 inches in diameter. It will probably be used for guided missiles, target aircraft and for assisted take-offs.

One-man midget helicopter weighing less than 100 pounds has been developed by Rotor-Craft Corp., Glendale, Calif., under an Office of Naval Research contract. The "Pinwheel" consists of a small two-blade rotor and fuel supply which are strapped to the pilot's body. Power stems from liquid rocket motors located at the blade tips.

First Boeing B-47 Stratojet has been turned over to Strategic Air Command officials at MacDill AFB, Fla., and several others are scheduled to be delivered soon.

Hughes XH-17 cargo helicopter, which was damaged in a test accident some months ago, is being modified from ground rig test status into a flying model.

Air Transport Association officials feel the Petroleum Administration for Defense order increasing the tetraethyl lead content of commercial aviation gasoline will aggravate maintenance problems for aircraft without saving much aviation gas. The new order, ATA says, will result in more spark plug fouling, more valve trouble and more sludge problems.

First test flight of the Diesel Power, Inc., 125-horsepower diesel engine in a standard Taylorcraft plane grossing 1,334 pounds has been completed. Company is now preparing plans for production of the engine beginning with the present 100-125 horsepower version.

All Lockheed P2V-4 Neptunes are now equipped with Wright Turbo Cyclone engines following the engine replacement program on the first 25, which were temporarily equipped with R-3350's.

American Aviation

NEWSLETTER ABC **Vol. 15 No. 23**

WAYNE W. PARRISH, Editor and Publisher
ERIC BRAMLEY, Executive Editor

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Armour Research Foundation, Illinois Institute of Technology, has developed an improved method of muffling jet engine noise during ground tests. A new unit channels jet noise through a series of 180-degree turns, each turn "killing" at least 15 decibels.

Production of the de Havilland Comet is now at the rate of 1½ to 3 a month and the three currently flying have a total of 1,200 hours in the air. Trans-Atlantic Comet service, using Avon engines, will probably not start until late in 1953.

John H. Geisse, former CAA official, has designed a simplified cross-wind landing gear for use on all types of lightplanes. It weighs about four pounds per wheel and is expected to sell for about $150 as against comparable present production units costing over $400.

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MILITARY

Air Force has tightened up on the use of its special mission aircraft and the move is expected to mean increased military business for commercial airlines. Instructions to all major commands state that "commercial means will be utilized where it is obviously less costly to the Air Force and no compelling reasons exist justifying a special military airplane. Prestige and convenience are generally not sufficient grounds for use of military aircraft." Commanders are to "review local procedures and insure that effective screening agencies are established to which requests for special air mission flights are referred and that these agencies are properly briefed on current Air Force policy."

USAF Major John P. Stapp and Capt. Walter S. Diehl (USN-Ret.) have received 1951 awards for aviation research from the National Air Council. Stapp was cited for his work on deceleration encountered in plane crashes, while Diehl was honored for directing research in the transonic speed range.

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CONGRESS

Hearings on S.436, the bill to separate airline subsidies and mail pay, will have to be held by the House Interstate and Foreign Commerce Committee in January, according to committee chairman Robert Crosser (D., Ohio). He added that the hearings may be short in view of the Senate committee's extensive sessions on the legislation.

Sen. Pat McCarran (D., Nev.) has introduced S.2344, which would provide construction differential subsidies for U.S. international air carriers to compensate them for differences in costs between U.S. and foreign-built aircraft. The bill has been referred to the Senate Interstate and Foreign Commerce Committee and hearings may start after Congress reconvenes in January.

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AIRLINES

Merger of Continental Air Lines and Mid-Continent Airlines would save government about $1 million annually in subsidy, according to CAB, which has ordered the carriers to show cause why such consolidation shouldn't take place. CAB said the lines "have been and are now receiving a total amount of mail pay that is substantially in excess of the amount required to compensate them for the service of transporting mail." Robert F. Six, CAL president, called CAB's proposal "a move in the right direction." J. W. Miller, MCA president, said his company is "willing to explore" possibilities of consolidation with CAL or any other connecting air carrier.

Two more DC-6B's have been ordered by United Air Lines, bringing its total purchases of the plane to 22. Deliveries are scheduled for 1952 and 1953.

New contract between United Air Lines and Air Line Pilots Association gives UAL pilots substantial increases but contains no mileage limitation. It allows a straight 1½c per mile for each mile flown with no limitation on the number of miles that may be flown in a month. Contract calls for overall pay increase of about 16%. Senior pilot may earn maximum of from $1,051 on DC-3's to $1,512 on Stratocruisers by flying 85 hours monthly, compared with previous $912 to $1,381, respectively. Co-pilots may earn from $675 on DC-3's to $906 on Boeings, against previous $570 and $600. Increases are retroactive at rate of $100 per month for periods of 10 to 12 months in case of captains and 21 months for co-pilots. Contract also contains fringe benefits, such as pay for 50% of flight time when deadheading at company request to cover flights, and minimum guarantee for reserve pilots.

International Air transport mobilization study undertaken last spring by Harvard Business School under contract from Commerce Dept. was completed some time ago and is classified secret, it has been learned. Strictly unofficial version of why it is so classified is that recommendations were contrary to Commerce Dept. views. It is believed that the study recommended that international air transport mobilization planning be handled by a mobilization agency and not in Commerce or any other regular government agency.

New California intrastate air coach operation with Lockheed Electras is planned by Golden State Airlines, organized by D. W. Mercer, charter operator at Lockheed Air Terminal. Company plans one round trip daily Burbank-Fresno-Sacramento at $9.95 Burbank-Fresno and $15.50 Burbank-Sacramento. Planes are leased from Lease-Air Corp., with which Mercer is also affiliated.

Alaska Airlines, which grounded its DC-4's and suspended service between Pacific Northwest and Fairbanks only a few days after it was inaugurated, planned to resume schedules Nov. 2 with two round-trips weekly. More schedules will be added as DC-4's come out of maintenance.

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CIVIL AERONAUTICS BOARD

Extension of Air France's trans-Atlantic route through New York to Houston and Mexico City was recommended last week by CAB Examiner Curtis C. Henderson. In an expedited proceeding, Henderson also proposed Air France service to Miami and over a Martinique-Guadeloupe-New York segment. All are in line with the U.S.-France bi-lateral air transport agreement. But American Airlines took exception to the New York-Mexico City recommendation because it is forced to stop New York-Mexico City flights at Dallas.

The highly-complex New York-Balboa Through Service Proceeding moved a step nearer completion last week as hearings were closed by

CAB Examiner T. L. Wrenn. In progress for three and one-half weeks and involving numerous potential interchange services between New York and Latin America, hearings were marked by repeated indications that additional litigation would greet certain Board findings not favorable to the Eastern and Pan American camps. Also significant was the unexpected support of the W. R. Grace interests in Panagra for a Pan American-Panagra-Eastern interchange service. Because of international route implications, final decision in the case rests with the White House.

Practice of filing successive petitions for reconsideration of final CAB orders without advancing new arguments will be eliminated by the Board on and after Dec. 1. Currently there is no limit on the number of such petitions that may be filed by a single party. But CAB indicated continuation of the practice would impose an undue burden upon the work of the Board and said that it would not entertain more than one such petition after Dec. 1, unless wholly new arguments are involved.

A new helicopter service within an 85 mile radius of San Francisco has been proposed to CAB by California Helicopter Company. Request was for authority to carry passengers, mail and cargo.

Opposition to the proposed Chicago-Mexico City interchange of Chicago and Southern Air Lines and Pan American World Airways was expressed by counsel for CAB's air operations bureau last week. In a brief to the Board, counsel said the interchange would improve existing service and benefit a small volume of traffic, but not enough to outweigh other considerations affecting the public interest. Emphasis was placed on possible adverse effect approval might have on future U.S. negotiations with Mexico over a bi-lateral agreement.

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CIVIL

CAB Chairman Donald W. Nyrop has been named to succeed Delos W. Rentzel as chairman of the Air Coordinating Committee. Rentzel held the ACC post before leaving CAB to become Undersecretary of Commerce for Transportation.

Membership in the Corporation Aircraft Owners Association has grown 33 1/3% in the last seven months. Members operate more than 400 planes of which 300 are multi-engine craft.

The 1951 Wright Brothers Memorial Trophy has been awarded to Dr. Jerome Clark Hunsaker, chairman of the National Advisory Committee for Aeronautics and former head (1933-51) of the Department of Aeronautical Engineering of Massachusetts Institute of Technology. Formal presentation will be made on Dec. 17 at annual Wright Memorial Day Dinner, Washington, D. C.

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LABOR

Wage Stabilization Board has started hearings on cases involving UAW-CIO and Douglas Aircraft and UAW-Wright Aeronautical Corp. About 10,000 workers of each firm returned to work after strikes while WSB special panels review the issues.

About 33,000 North American Aviation employes have received a one-cent-an-hour wage hike as a result of the jump in the cost-of-living index. Since October, 1950, NAA workers have received a total of 11c an hour in cost-of-living boosts.

WSB approval is expected for the 5% blanket wage boost negotiated between Douglas Aircraft Co. and IAM-AFL. New top scale would equal Boeing's $2.26 an hour.

Maintenance electricians at Convair-Fort Worth have voted to be represented by the International Brotherhood of Electrical Workers-AFL. The vote was 92 for the IBEW, 27 for IAM and two favored neither union.

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FINANCIAL

Northrop Aircraft, Inc. netted $3,276,053 on sales of $89,694,057 for the fiscal year ended July 31. This compares with a net loss of $44,974 on sales of $43,876,086 for the 1950 fiscal year.

Republic Aviation Corp. had $2,141,407 profit on sales of $83,077,697 for the nine months ended Sept. 30 as against a net of $1,023,455 on sales of $43,021,600 for the same 1950 period. Backlog on Sept. 30 was more than $550,000,000.

Thompson Products, Inc. and subsidiaries netted $5,627,001, or $4.53 a share, on sales of $139,720,010 for the first nine months of 1951 as against a net of $6,415,763, or $5.20 a share, on sales of $85,665,979 for the same period of 1950.

Garrett Corp. and subsidiaries netted $1,873,099, or $2.98 a share, on sales of $33,056,585 for the fiscal year ended June 30 as against a net of $2,043,372, or $3.25 a share, on sales of $22,204,909 for the previous year. Backlog is $124,000,000.

United Air Lines will pay a 75c common stock dividend Dec. 15 to stockholders of record Dec. 4. Regular $1.125 dividend on the 4½% accumulative preferred stock will be paid Dec. 1 to stockholders of record Nov. 16.

Northwest Airlines netted $1,464,423 for the nine months ended Sept. 30 on gross revenues of $36,700,970 as against a loss of $774,721 on revenues of $35,485,944 for the comparable 1950 period.

Chicago and Southern Air Lines will pay a 40c dividend Dec. 3 to common stockholders of record Nov. 20.

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AROUND THE WORLD

France, although it has adopted the British Decca system as the standard air navigation unit for its domestic airways, is planning to use ICAO-approved VOR (omnirange) on international air routes passing through France. Decca is less expensive and the French feel their internal routes with relatively light traffic will not require VOR.

BOAC earned $5,866,000 more overseas than it spent there during the first five months of the current fiscal year, an increase of 48% over the $1,889,600 in net foreign currency earnings for the same period of 1950.

SABENA Belgian Air Lines had a net loss for 1950 of $412,760 as against a 1949 deficit of $1,783,056. Belgium-Congo route accounted for 50% of the company's business last year.

French firm of Hispano-Suiza reports its first Rolls-Royce licensed "Tay" turbojet engine has passed acceptance tests.

British European Airways is considering installing Rolls-Royce Dart turboprops on its Airspeed Ambassadors to boost performance and payload.

SIAI-Marchetti, Italy's one-time leading plane builder, has been liquidated by stockholders after losing 49,700,000 lira in 1950. Loss in 1949 was only 1,300,000 lira.